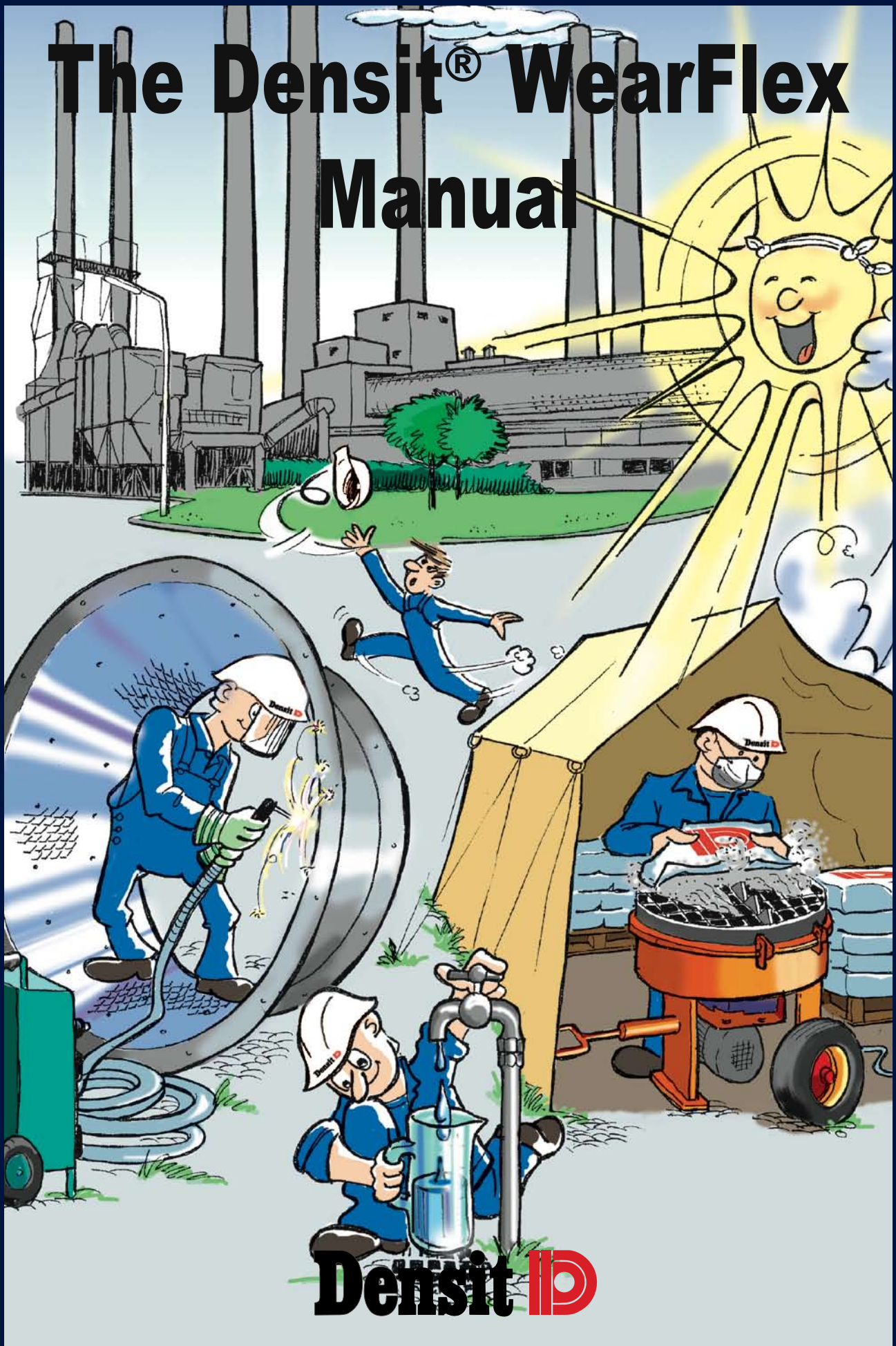


The Densit® WearFlex Manual



Densit 

PREPARATION OF THE WORK SITE

PREPARATION OF THE FABRICATION

MIXING

INSTALLATION



Densit ApS, 44, Rørdalsvej, DK-9100 Aalborg
Phone: + 45 9816 7011
Fax: + 45 9933 7788
E-mail: mail@densit.com
Internet: www.densit.com

FINISHING

Introduction

The series of Densit® WearFlex products is developed to be as mortable as possible. It is a unique feature of Densit® WearFlex products that they are installed on an anchoring mess to give a high degree of freedom with respect to geometrically shapes compared to cast wear linings and tiles.

The aim of this manual is to ensure the correct installation of Densit® WearFlex linings with regard to both technique and workmanship. The manual must be one of the tools used by the person or persons responsible for installation during the planning and execution of the work, as well as when the product is put to use.

Most of the content of this manual is of a general nature concerning Densit® WearFlex products. Part of the manual concerns the special requirements that must be met when using and applying Densit® WearCast HT products or when applying Densit® WearCast products for on site casting purposes.

The manual cannot stand alone. It is the responsibility of the person doing the installation to ensure the quality of execution of each individual task. The manual should be combined with the general technical know-how and workmanship of the person doing the installation. In practice, conditions may differ somewhat from those on which the instructions in this manual are based. Thus, the manual cannot replace professional precision or the ability to assess and respond to the special conditions presented by the individual task.

**PLEASE NOTE SPECIAL CONDITIONS
FOR WEARCAST/FLEX HT PRODUCTS**

| | | |
|-------------|---|-------------|
| 1 | Preparation of the work site | 1.1 |
| 1.1 | Checklist | 1.2 |
| 1.2 | Storing Densit® WearFlex | 1.3 |
| 1.3 | Access and working conditions | 1.4 |
| 1.4 | Power supply and water | 1.5 |
| 1.5 | Climatic conditions | 1.6 |
| 1.6 | Equipment | 1.8 |
| 1.7 | Installers | 1.10 |
| 1.8 | Lifting gear | 1.11 |
| 1.9 | Safety data sheet | 1.12 |
| 2. | Preparation of the fabrication | 2.1 |
| 2.1 | Checklist | 2.2 |
| 2.2 | Preparation of the steel fabrication | 2.3 |
| 2.3 | Retaining bars | 2.4 |
| 2.4 | Welding of the anchoring | 2.5 |
| 2.5 | Choice of anchoring system | 2.6 |
| 2.6 | Expanded mesh directly on the fabrication. Anchoring Type 1 | 2.9 |
| 2.7 | Expanded mesh on rods. Anchoring Type 2 | 2.10 |
| 2.8 | Profile bent expanded mesh. Anchoring Type 3 | 2.11 |
| 2.9 | Expanded mesh with dents. Anchoring Type 4..... | 2.12 |
| 2.10 | Preparation prior to installation | 2.13 |
| 2.11 | Special conditions for HT products | 2.14 |
| 2.12 | Building the mould and shuttering (Casting only) | 2.17 |
| 3. | Mixing | 3.1 |
| 3.1 | Checklist | 3.2 |
| 3.2 | Mixing site requirements | 3.3 |
| 3.3 | Mixer requirements | 3.4 |
| 3.4 | Climatic conditions | 3.5 |
| 3.5 | Mixing procedures | 3.6 |
| 3.6 | Special conditions for HT products | 3.9 |
| 3.7 | Special conditions for casting on site (Casting only) | 3.11 |
| 4. | Installation | 4.1 |
| 4.1 | Checklist | 4.2 |
| 4.2 | Equipment | 4.3 |
| 4.3 | Confirming the fabrication | 4.4 |
| 4.4 | Confirming the anchoring | 4.5 |
| 4.5 | Climatic conditions | 4.6 |
| 4.6 | Joints | 4.7 |
| 4.7 | Confirm installation | 4.8 |
| 4.8 | Method of procedure | 4.9 |
| 4.9 | Special conditions for HT products | 4.13 |
| 4.10 | Special conditions for WearCast used on site | 4.14 |

| | |
|--|------------|
| 5. Finishing | 5.1 |
| 5.1 Checklist | 5.2 |
| 5.2 Applying curing compound | 5.3 |
| 5.3 Strength development | 5.4 |
| 5.4 Repair of Densit® WearFlex | 5.5 |
| 5.5 Drying out of Densit® WearFlex | 5.6 |
| 5.6 Special conditions for WearCast used on site | 5.7 |

1. Preparation of the work site

Establishing a functional work site helps ensure the best possible installation. The following chapter provides instructions for establishing the work site.

Table of contents

| | |
|--|------------|
| 1. Preparation of the work site | 1.1 |
| 1.1 Checklist | 1.2 |
| 1.2 Storing Densit® WearFlex | 1.3 |
| 1.3 Access and working conditions | 1.4 |
| 1.4 Power supply and water | 1.5 |
| 1.5 Climatic conditions | 1.6 |
| 1.6 Equipment | 1.8 |
| 1.7 Installers | 1.10 |
| 1.8 Lifting gear | 1.11 |
| 1.9 Safety data sheet | 1.12 |



1.1 Checklist

| | Section | OK | |
|----|--|-----------|--|
| 1 | Is the mixing site/work site adequately covered? | 1.5 | |
| 2 | Is there access to clean water? | 1.4 | |
| 3 | Is the power supply correct for the mixer? | 1.4 | |
| 4 | Are working and access conditions in order? | 1.3 | |
| 5 | Is there equipment to transport Densit® WearFlex? | 1.3 | |
| 6 | Is the necessary equipment to protect Densit® WearFlex against adverse weather conditions available? | 1.5 | |
| 7 | Is equipment for cleaning the surface available? | 1.6 | |
| 8 | Is suitable welding equipment available? | 1.6 | |
| 9 | Are the correct types of mixer and tools available? | 1.6 | |
| 10 | Have the work crew been given the necessary training? | 1.7 | |
| 11 | Is the necessary number of workmen available? | 1.7 | |
| 12 | Is the necessary lifting gear capacity for any required fitting of parts available? | 1.8 | |
| 13 | Is the necessary vibration equipment available? (Casting only) | 1.6 | |
| 14 | Is the necessary tool and material to build moulds and shuttering available? (Casting only) | 1.6 | |

1.2 Storing Densit® WearFlex

Densit® WearFlex

Densit® WearFlex must always be protected from rain and moisture during storage. The pallets may be raised 20 cm, so that moisture cannot penetrate from below.

The material must be used no later than 12 months from the date on the bag. Material in packaging that has been opened should never be used. There must be no hard lumps in the material when the bags are opened. Damaged material should be discarded.

To ensure correct mixing of the compound Densit® WearFlex should be stored at a temperature of at least 5°C for 48 hours before the material is used.

Densit® Curing Compound

Densit® Curing Compound cannot withstand frost and should therefore always be stored in a frost-free place. Densit® Curing Compound should be used within 12 months from the date of the delivery note. If there are lumps in the curing compound due to exposure to heat, these lumps can be removed by shaking the curing compound before use. Lumps must never be removed by using a sieve.



1.3 Access and working conditions

Good working and access conditions are of major importance in ensuring the best possible installation of Densit® WearFlex.

Mixing site

The mixer must be placed as close to the work site as possible. If the mixer cannot be placed in the immediate vicinity of the work site, lifting equipment or other means of transport must be used to ensure quick transport of the finished compound.

The work site

Easy, quick access to the work site must be ensured. A temporary manhole can be made to ensure this can be obtained.



There must be good access to the areas where Densit® WearFlex is to be applied. If possible, scaffolding can be erected to give the person applying Densit® WearFlex a good working posture to ensure work of the highest quality.

1.4 Power supply and water

Power supply

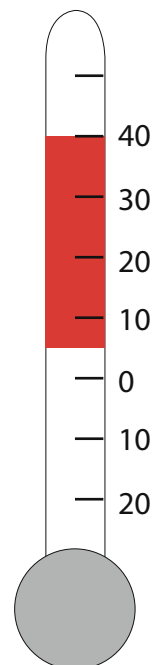
Sufficient current/output must be available to meet the requirements of the mixer used. Note that mixing Densit® WearFlex requires greater output than the mixing of most other casting materials. A generator may be used in the event of shortage of power supply or power failure.

Water

Clean water must **ALWAYS** be used when mixing Densit® WearFlex. Impurities in the water can reduce the strength and durability of the compound and cause problems in the mixing of the compound. The water used for cleaning tools, and the like, must not be used for mixing the compound.

If water is supplied by hose or from a water tank, it should be noted that the water may become very hot if it has not been adequately covered, which will have adverse effects on Densit® WearFlex.

The correct water temperature is 5 to 40°C.



1.5 Climatic conditions

The climatic conditions on the work site are very important for the application and quality of the Densit® WearFlex installation.

Working temperatures for Densit® WearFlex are from 5 to 40°C.

Avoid direct exposure to sun, rain and wind by covering the mixing site/work site.

Frost

Densit® WearFlex must never be applied if the temperature of the fabrication to be covered or at the work site is below 5°C. Protect with insulating blankets or install a hot-air heater. If the Densit® WearFlex lining is exposed to frost before the material has set, it will be damaged due to the formation of ice crystals. This will, among other things, reduce the strength and durability of the Densit® WearFlex lining.

Heat

Densit® WearFlex must never be applied if the temperature of the fabrication to be covered or at the installation site is higher than 40°C. In such a case, application may be carried out at night. At temperatures of more than 40°C, too much water will evaporate from the compound. This will lead to a considerable reduction in the workability and mechanical characteristics of the finished Densit® WearFlex lining.



Water temperature

Use water at temperatures from 5°C to 40°C, depending on the temperature of the surroundings.

If using water from hoses or water tanks, make certain that the water is not too hot before adding Densit® WearFlex.

When mixing at high temperatures, it is advantageous to use cold water.
When mixing at low temperatures it is advantageous to use hot water.

Mixer

A paddle pan mixer such as a Staring L.H. 125 with reinforced gear and motor may be used.

Technical data - Staring L.H. 125

| | |
|---------------------------------|------------|
| Gross volume: | 125 l |
| Yield per mix: | 100 kg |
| Pan diameter: | 735 mm |
| Pan height inside: | 315 mm |
| Total height: | 1150 mm |
| Total weight: | 140 kg |
| Emptying height: | 650 mm |
| Main axle rpm | 34 |
| Number of mixer shovels: | 4 |
| Electric motor (3x400 V-50 Hz): | 2.2 kW |
| Connection: | 16amp plug |



1.7 Installers

To ensure satisfactory results, the installers who carry out the work must have the necessary training and experience.

If trained installers are not available for the job, proper training should be given by Densit ApS or by Densit's local partner prior to start of the job. Supervisors from Densit ApS or Densit's local partner should be present during the installation.

It is recommended that the same man should stay by the mixer while the work is carried out to ensure a uniform consistency of each batch of compound. When the compound is spread, there must be a sufficient number of workers to complete the application within the boundaries of limited areas in a single, continuous operation.



1.8 Lifting gear

When applying Densit® WearFlex to unassembled (disassembled) parts, lifting gear with the capacity necessary to install the part after application must be used.

When handling or lifting parts to which Densit® WearFlex has been applied, it should be noted that the Densit® WearFlex lining **adds the following extra weight:**

20 mm lining: approx. 60 kg/m²

30 mm lining: approx. 90 kg/m²

40 mm lining: approx. 120 kg/m²



1.9 Safety Data Sheet

SAFETY DATA SHEET

European Parliament and Council Regulation (EC) No 1907/2006 of 18 December 2006 concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)

1. Identification of material/product and of company

Name of product: Densit® WearCast 500, 1000, 2000, 2000 HT, 3000 - Densit® WearFlex 500, 1000, 1000 HT, 2000, 2000 Rapid, 2000 HT, 3000 - Densit® WearSpray 500, 2000 - Densit® WearTix 2000

Applications: Castable materials for wear resistant, hard and impervious coatings, linings and castings.

Manufacturer: Densit ApS · 44, Rørdalsvej · PO Box 220 · DK-9100 Aalborg · Denmark
Telephone + 45 98 16 70 11 · Telefax: + 45 99 33 77 88

2. Composition/information on ingredients

| <u>Ingredient</u> | <u>CAS number</u> | <u>Content %</u> | <u>Hazard Classification</u> |
|-------------------|-------------------|------------------|------------------------------|
| Portland Cement | 65997-15-1 | 0-97 | Xi, R37/38-41 |

3. Hazards

Inhaling dust from the products can irritate the throat and cause coughing. Frequent inhaling over very long periods may cause lung diseases. Dust as well as splashes from the products when mixed with water may cause permanent eye disease. Rinse immediately with plenty of water. Dust from the products can irritate wet skin. Skin contact with the products when mixed with water may cause cauterization.

4. First aid

After inhaling: The person affected should be moved into fresh air and kept calm under observation. If necessary, seek help in the emergency room taking this data sheet with you.

After skin contact: Remove any contaminated clothing and rinse the skin thoroughly with water.

After eye contact: Rinse immediately with plenty of water for at least 15 minutes. Remove any contact lenses and open the eyes wide. In case of continued irritation, continue rinsing during transport to the emergency room. Bring these instructions with you.

After swallowing: Rinse the mouth immediately and drink plenty of liquid, preferably milk. Keep the person concerned under observation. Do not provoke vomiting. If there is vomiting, keep the head low. Bring the person concerned to the emergency room immediately. Bring these instructions with you.

5. Fire-fighting

Appliances: No special requirements. Fire-fighting appliances are to be chosen with due regard to any other chemicals present.

Special risks: The product is non-combustible.

6. Special precautions in case of accidental spillage

Personal safety precautions: Avoid inhaling dust, lengthy contact with skin and contact with eyes.

Environmental protection: Densit® products should not be disposed of in nature but be collected and delivered in accordance with arrangements made with the local authorities.

Cleaning up: Spilt material should be removed with a vacuum cleaner. Avoid spreading dust.

7. Handling and storage

Handling: Avoid spreading dust.

Storage: Should be stored in a closed original packing. Densit® products must be kept in a dry place, out of the reach of children.

8. Exposure control/personal protection

Workplace facilities: Easy access to plenty of water and to eye baths.

Limit values: Mineral dust, inert: 10 mg/m³. Ref. Danish Factory Inspectorate instruction 3.1.0.2. Respirable dust, inert: 5 mg/m³.

Personal protection: In dusty conditions, protective mask with particle filter (min. P2) to be used. Use rubber safety gloves and, where there is a risk of the whirling up of dust or splashing with Densit® mix, use goggles/face screen.

Other: On completion of work and before a work break, wash hands thoroughly and apply moisturizing cream. After work, remove dirty clothing and wash the skin thoroughly with soap and water.

9. Physical and chemical characteristics

Appearance: Form: Powder Smell: None

pH value: About 13 (product dissolved in water).

10. Stability and reactivity

Stability: Stable.

Circumstances/materials to be avoided: The products set on contact with water and moisture.

Dangerous breakdown products: None.

11. Toxicological information

Inhalation: Dust may irritate respiratory passages and cause throat irritation and coughing.

Skin contact: Dust will irritate moist skin. Contact with the product when mixed with water may cause cauterization.

Eye contact: Dust or splashing from products when mixed with water involves the risk of serious eye injury.

Swallowing: Swallowing could cause extreme irritation of the mouth, throat and gastrointestinal canal.

Long-term effects: Frequent inhalation of dust over a long period may cause serious lung disease.

12. Environmental information

Mobility: Immobile. *Degradability:* Is not degradable.

13. Disposal

Large quantities of waste are to be delivered in accordance with arrangements made with the local authorities.

14. Transport information

Regarded as safe for transport purposes.

15. Information on regulation



Irritant (Xi)

Classification and marking in accordance with regulation no. 829 of the Danish Ministry of the Environment. When mixing with water calcium hydroxide is formed which can have a corrosive effect on the skin and to the eyes.

Irritating to respiratory system and skin.
Risk of serious damage to eyes.

Keep out of the reach of children.
In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
Packaging must be stored dry.

16. Other information

Instruction/limitations: The user must have been instructed in working methods and know the contents of this data sheet.

2. Preparation of the fabrication

Correct attachment of the anchoring to the fabrication is vital for correct installation. This chapter describes the type of anchoring that should be used and how to attach it.

Table of contents

| | | |
|-------------|---|-------------|
| 2. | Preparation of the fabrication | 2.1 |
| 2.1 | Checklist | 2.2 |
| 2.2 | Preparation of the steel fabrication | 2.3 |
| 2.3 | Retaining bars | 2.4 |
| 2.4 | Welding of the anchoring | 2.5 |
| 2.5 | Choice of anchoring system | 2.6 |
| 2.6 | Expanded mesh directly on the fabrication. Anchoring Type 1 | 2.9 |
| 2.7 | Expanded mesh on rods. Anchoring Type 2 | 2.10 |
| 2.8 | Profile bent expanded mesh. Anchoring Type 3 | 2.11 |
| 2.9 | Expanded mesh with dents. Anchoring Type 4 | 2.12 |
| 2.10 | Preparation prior to installation | 2.13 |
| 2.11 | Special conditions for HT products | 2.14 |
| 2.12 | Building the mould and shuttering. (Casting only) | 2.17 |



2.1 Checklist

| | Ref: DK/WF | OK |
|---|-----------------------|-----------|
| 1 Is welding equipment available? | 2.2 | |
| 2 Is there a high pressure cleaner, and are braces and other necessary equipment available? | 2.2 | |
| 3 Has the fabrication been prepared prior to the welding of the anchoring? | 2.2 | |
| 4 Has the placement of retaining bars been determined? | 2.3 | |
| 5 Has the type of anchoring been determined | 2.5 | |
| 6 Has the anchoring been correctly welded to the fabrication? | 2.4 | |
| 7 Has the fabrication been cleaned/prepared after the welding on of the anchoring? | 2.10 | |
| 8 Is the mould and shuttering supports safe? (Casting only) | 2.11 | |
| 9 Is the mould and shuttering coated with mineral oil? (Casting only) | 2.12 | |
| 10 Can the vibrators be clamped to the moulds and mould and shuttering? (Casting only) | 2.13 | |

2.2 Preparation of the steel fabrication

Equipment

The following equipment must be available in order to attach the anchoring to the fabrication.

- Welding equipment for welding on the anchoring
- Shears for cutting mesh
- A high pressure cleaner, or the like, for cleaning the fabrication
- Support irons/retaining bars
- If necessary, insulating blankets for covering the fabrication

Inspection

Make certain that the anchoring is attached only to a steel fabrication of high quality welding steel. Repair or replace any poor quality steel parts before attaching the anchoring. Make certain the fabrication has the correct shape. Distorted steel parts must be straightened and any necessary reinforcement of the fabrication carried out before the anchoring is attached.

The braces must be positioned in such a way that they can be disassembled after the installation of Densit® WearFlex.

Cleaning

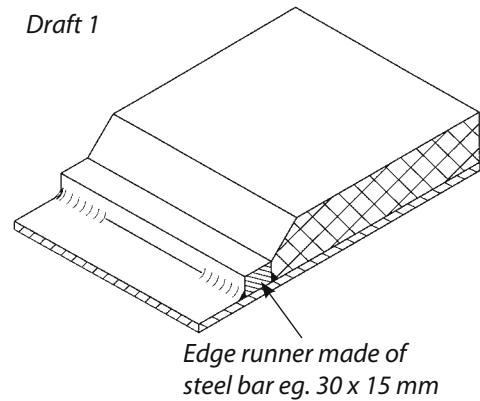
All loose rust and soot, oil, grease or any loose particles must be removed from the surface of the areas on which Densit® WearFlex is to be applied. A watertight coating must be applied to galvanized surfaces or surfaces of lightweight metal alloy, eg aluminium, to hinder a chemical reaction between the metal and Densit® WearFlex.

The fabrication can be cleaned by high pressure cleaning, sand blasting or a similar method, depending on the condition of the fabrication.

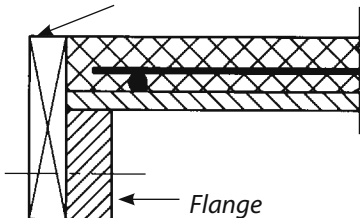


2.3 Retaining bars

If the wear material can hit the Densit® WearFlex lining at a right angle the lining must be protected with a permanently fitted retaining bars. The retaining bars must hinder the wear material in getting in between the fabrication and the Densit® WearFlex lining. If, for example, the Densit® WearFlex lining ends at the centre of the steel casing the retaining bars can be fitted as shown on the drawing.



Draft 2
Temporary stopflange
made of steel or wood



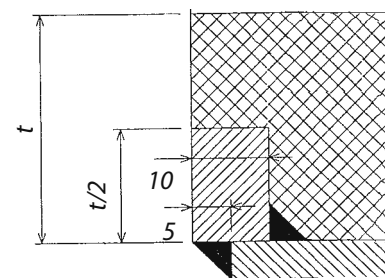
Solid flat bars can be used as retaining bars, typically 30x15 mm. In the case of round steel parts the flat bar must be milled to fit the steel part. The flat bar must be welded to avoid there being any air between the flat bar and the fabrication. Typically, 50 mm welds should be made for each 150-200 mm.

Steel parts which end with flanges or the like, should always be fitted with temporary stop flanges. The stop-flanges must ensure that the Densit® WearFlex lining is finished with a sharp edge of the correct thickness.

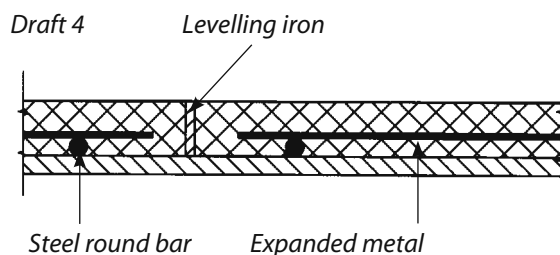
For example, the stop flange can be made of a hard wooden sheet or a flat bar.

Steel parts which do not end with flanges must have a permanent retaining bars welded on to reinforce the steel casing and protect the edge of the Densit® WearFlex lining.

Draft 3



If the Densit® WearFlex lining is to be installed on large areas it is advantageous to fit levelling irons on the fabrication. The levelling irons are to ensure that the lining is applied in the correct thickness. Levelling irons are fitted so the area is divided into suitable working areas.



Levelling irons can be made of band iron. These should measure 2 mm x the thickness of the Densit® WearFlex lining.

If the levelling iron is also to act as a reinforcement of the steel casing, the thickness should be increased to achieve the desired support.

Alternatively, if the levelling iron is not to act as a support for the steel casing, temporary wooden mouldings can be used, see chapter 4.6.

2.4 Welding of the anchoring

The correct welding of the expanded mesh is a prerequisite for the successful installation of Densit® WearFlex.

The recommended spaces between welds and between rods are intended only as guidelines. You must **ALWAYS** make certain the expanded mesh is welded on in such a way that it is not loose or dented and has the same distance from the casing throughout.

MIG/MAG (CO₂-CO₂/Ar)

If climatic conditions on site permit, MIG/MAG welding should be used. This method is efficient and gives good quality welding. A suitable welding wire, intended for use on the type of fabrication in question, must be used. Recommended diameter: 0.8 mm.

Electrode welding

Electrode welding can be used under all climatic conditions.

An electrode suitable for welding on the type of fabrication in question must be used. Recommended electrode diameter: 2.5 mm.

Irrespectively of the chosen welding process, the operator of the welding equipment must have an adequate training and possess the necessary skills to do correct welding. The operator must select the right welding electrodes that works with the anchoring mess the distance rods as well as the casing under the actual climatic conditions. The operator must select the welding parameters (gas-flow, welding current, etc.) according to selected welding electrodes, material thickness, climatic condition etc.).

During welding the materials (casing, distance rod and anchoring mesh) can lose their strength in the heat-affected zone and the mess can eventually be burned away. It is an invariable requirement that any single weld spot (casing – distance rod, distance rod – anchoring mesh, casing – anchoring mesh) each and every one as well as the surrounding material must be able to carry a load of at least 25 kg.

Trying to tear the mesh away by hand should check the strength. Make a check at least once per square meter.

2.5 Choice of anchoring system

Expanded mesh must be attached to the fabrication to ensure good anchoring of the Densit® WearFlex lining.

The following anchoring systems can be used:

Type 1: Expanded mesh on the fabrication. (Section 2.6)

Weld the expanded mesh directly to the steel fabrication.

Type 2: Expanded mesh on rods. (Section 2.7)

Weld the expanded mesh to the rods which have been welded directly onto the fabrication.

Type 3: Profile bent expanded mesh. (Section 2.8)

The expanded mesh has ribs which are to be welded to the fabrication.

Type 4: Expanded mesh with dents. (Section 2.9)

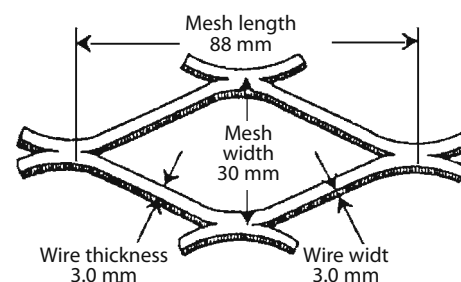
The expanded mesh has dents which are to be welded to the fabrication.

Each of the recommended anchoring systems has its own area of use. For example, one anchoring system is best for the vertical installation of Densit® WearFlex, whilst another is best for the installation of thin linings, etc.

It is often advantageous to combine different types of anchoring on the same installation assignment.

The standard types of expanded mesh used are 3088-3030 with 3x3 mm ribs.

Alternatively, a 5x50x50 mm reinforcement mesh can be used for horizontal installations.



For Densit® WearFlex linings of a thickness **less than 25 mm ($t \leq 25$ mm)**, the expanded mesh must be welded directly to the fabrication.

For Densit® WearFlex linings of a thicknesses **from 25 mm to and including 40 mm (25 mm $< t \leq 40$ mm)**, the expanded mesh must be welded on the fabrication using rods, a mesh with ribs or dents in order that the Densit® WearFlex can be correctly applied.

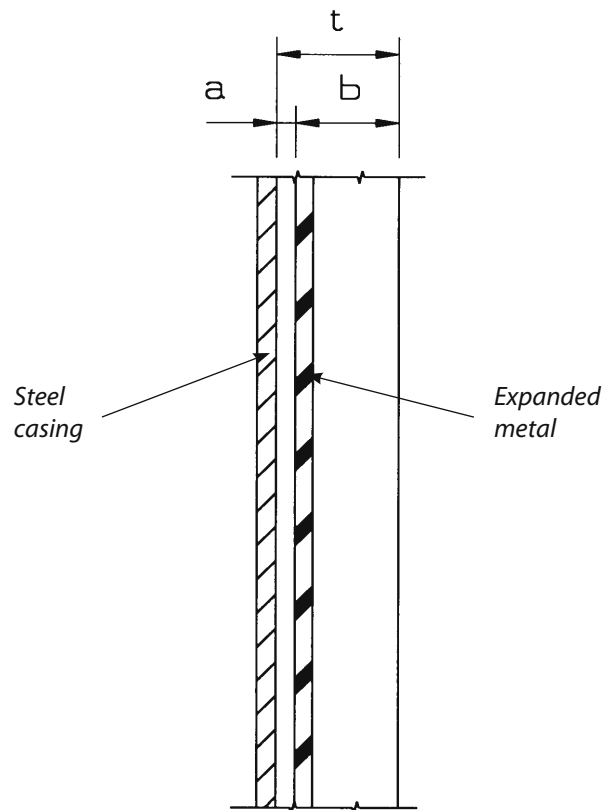
To create Densit® WearFlex linings of thicknesses of **more than 40 mm ($t > 40$ mm)**, contact Densit ApS for advice.

Preparation of the fabrication

24.09.2001.GB

The following figure shows the required distance from the fabrication.

| t mm | a mm | b mm |
|-----------|---------|-----------|
| ≤ 25 | 0 | ≤ 25 |
| ≤ 30 | 4-6 | 24-26 |
| ≤ 35 | 6-8 | 27-29 |
| ≤ 40 | 8-10 | 30-32 |



The following table gives an overview of the various types of anchoring.

| | Thickness of the installation: $t \leq 25$ mm | | | |
|------------|---|-------------------------------------|--|--|
| | Expanded mesh on the fabrication (Section 2.6) | Expanded mesh on rods (Section 2.7) | Profile bent expanded mesh (Section 2.8) | Expanded mesh with dents (Section 2.9) |
| Horizontal | Type 1 | | | |
| Vertical | Type 1 | | | |
| Overhead | | | | |

| | Thickness of the installation: 25 mm $< t \leq 40$ mm | | | |
|------------|---|-------------------------------------|--|--|
| | Expanded mesh on the fabrication (Section 2.6) | Expanded mesh on rods (Section 2.7) | Profile bent expanded mesh (Section 2.8) | Expanded mesh with dents (Section 2.9) |
| Horizontal | Type 1 | Type 2 | Type 3 | Type 4 |
| Vertical | | Type 2 | Type 3 | Type 4 |
| Overhead | | Type 2 | | |

2.6 Expanded mesh directly on the fabrication. Anchoring Type 1

Expanded mesh can be anchored directly to the casing for horizontal and vertical installations of thicknesses of 20-25 mm. The expanded mesh is used to ensure the correct installation of Densit® WearFlex.

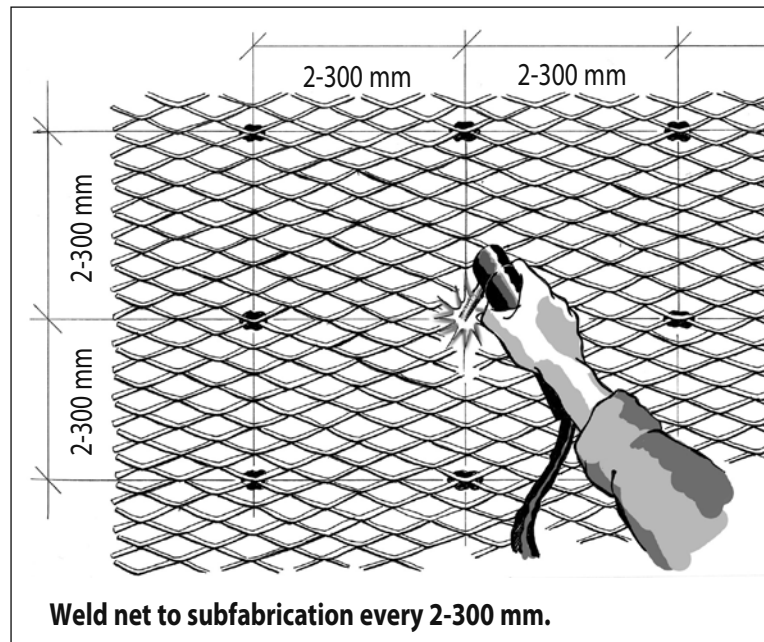
The following expanded mesh is recommended:
Type 3088-3030.

Installation guide:

1. Carefully adjust the expanded mesh to fit the area in question.
2. Weld the expanded mesh to the casing with approx. 200-300 mm between welds.

IMPORTANT:

The mesh must not be at all be bouncy. Spacing between the welds must be adjusted to keep the mesh from sagging (being springy or having dents) during the installation of Densit® WearFlex.



2.7 Expanded mesh on rods. Anchoring Type 2

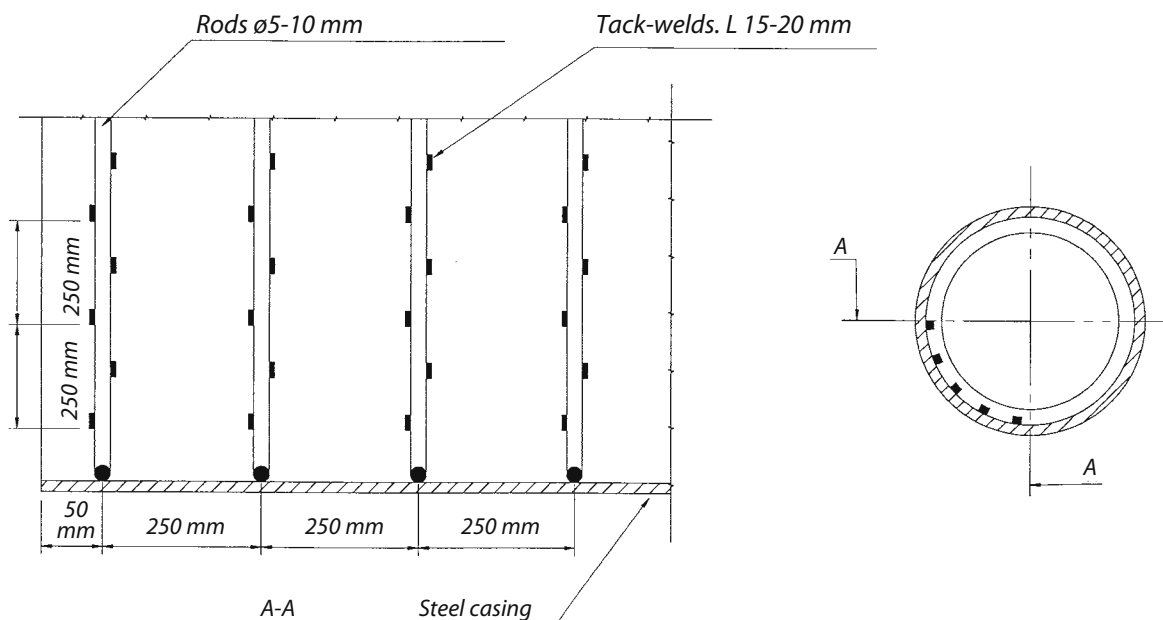
Rods must be welded between the expanded mesh and the fabrication to maintain the same distance between the expanded mesh and the fabrication throughout. This type of anchoring can be used for the installation thicknesses of between 25 and 40 mm ($25 \text{ mm} < t \leq 40 \text{ mm}$).

Rods of from 4 to 10 mm in diameter are to be used, depending on the thickness of the installation.

| Choice of rods | |
|-------------------------------|-------------|
| Thickness of Densit® WearFlex | Rods - dia. |
| 25 - 30 mm | Ø5-6 mm |
| 30 - 35 mm | Ø6-8 mm |
| 35 - 40 mm | Ø8-10 mm |

Installation guide

1. Cut suitable lengths of rods.
2. Place rods at intervals of approx. 200-300 mm.
3. Welds must be at intervals of approx. 200-300 mm. **ZIG-ZAG welding must be used.** For round steel constructions the rods must be placed to fit the shape.
4. Carefully fit the mesh to the fabrication and weld the mesh to the rods.
5. The welds must be at intervals of approx. 200-300 mm.



IMPORTANT:

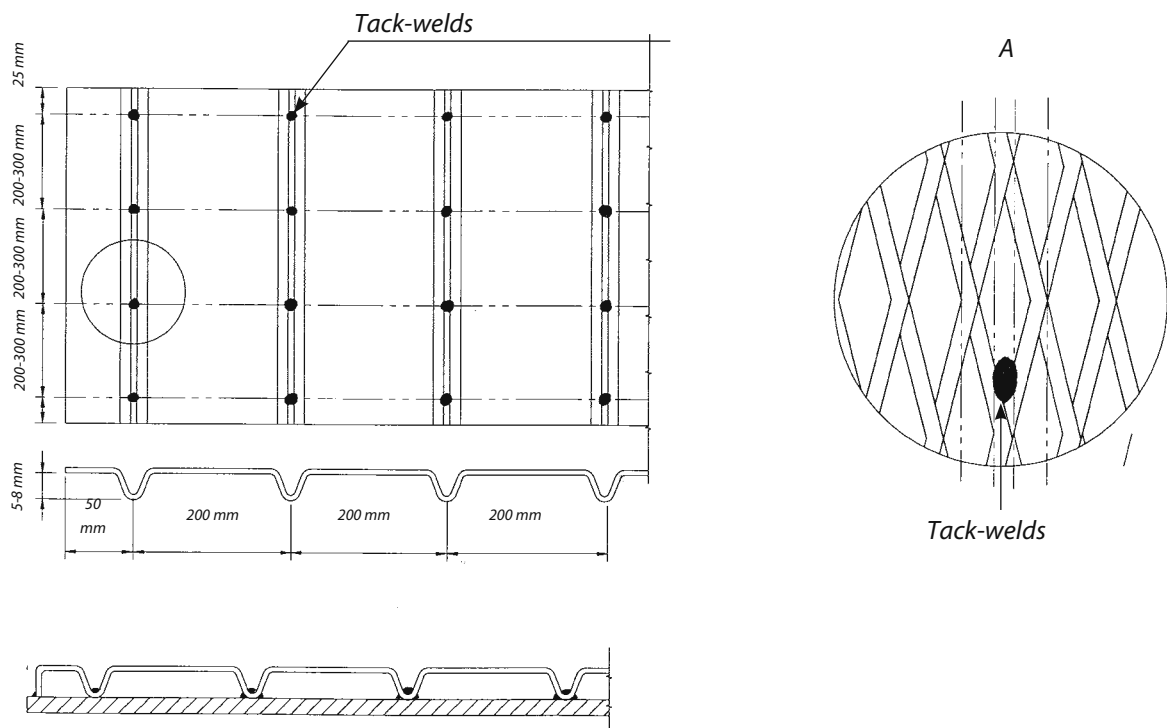
The mesh must not be all be bouncy. Spacing between the welds must be adjusted to keep the mesh from sagging (being springy or having dents) during the installation of Densit® WearFlex.

2.8 Profile bent expanded mesh. Anchoring Type 3

The expanded mesh can be bent at suitable intervals to ensure the same distance between the expanded mesh and the fabrication throughout. The bent ribs ensure that the same distance between the expanded mesh and the fabrication can be maintained. This type of anchoring can be used for application thicknesses of between 25 and 40 mm ($25 \text{ mm} < t \leq 40 \text{ mm}$), but should not be used for overhead installation. The following expanded mesh is recommended: Type 3088-3030 with bent ribs every 200 mm.

Installation guide

1. Carefully adjust the mesh to fit the fabrication.
2. The adjusted mesh must have a minimum width of 200 mm.
3. For round steel parts, the profile bent ribs must be placed at right angles to the curve.
4. Weld the mesh to the fabrication by welding at the bottom of the ribs. Distance between welds: 200-300 mm.



IMPORTANT:

The mesh must not be at all be bouncy. Spacing between the welds must be adjusted to keep the mesh from sagging (being springy or having dents) during the installation of Densit® WearFlex.

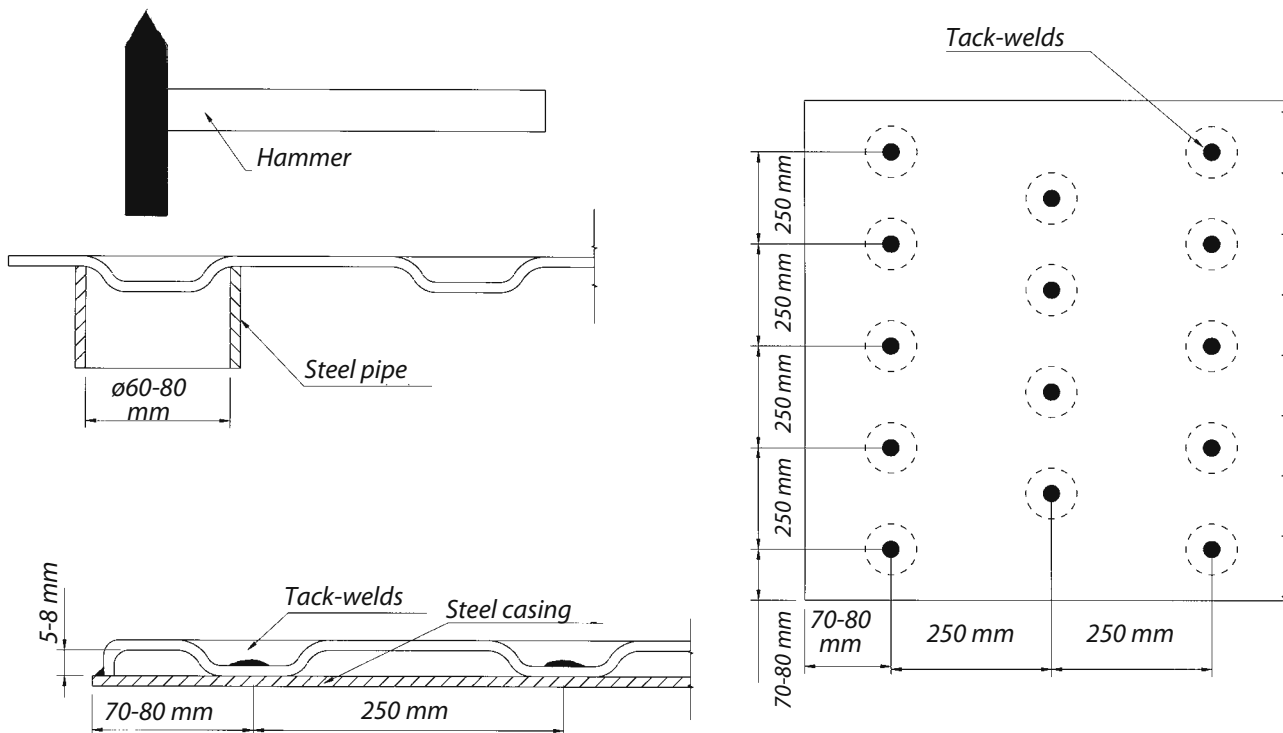
2.9 Expanded mesh with dents. Anchoring Type 4

The expanded mesh can have grooves/dents to ensure that the same distance between the expanded mesh and the fabrication is maintained throughout. This type of anchoring can be used for installation thicknesses of between 25 and 40 mm ($25 \text{ mm} < t \leq 40 \text{ mm}$) but should not be used for overhead installation.

Expanded mesh: Type 3088-3030 with dents/grooves.

Installation guide

1. Carefully adjust the mesh to the fabrication.
2. Make dents by placing the adjusted mesh over a steel ring (dia. approx. 50-80 mm) and hammer the mesh to make the desired dent.
3. Weld the mesh to the fabrication with welds at the bottom of the grooves formed.
Distance between welds: 200-300 mm.



IMPORTANT:

The mesh must not at all be bouncy. Spacing between the welds must be adjusted to keep the mesh from sagging (being springy or having dents) during the installation of Densit® WearFlex.

2.10 Preparation prior to installation

Steel surfaces

After welding on the anchoring and immediately prior to the installation of Densit® WearFlex, any loose rust and slag, soot, oil, grease, or the like, must be completely removed from the fabrication and anchoring. A high pressure cleaner or vacuum cleaner can be used.

A watertight coating must be applied to galvanized surfaces or surfaces of lightweight metal alloy, eg aluminium, to prevent a chemical reaction between the metal and Densit® WearFlex.

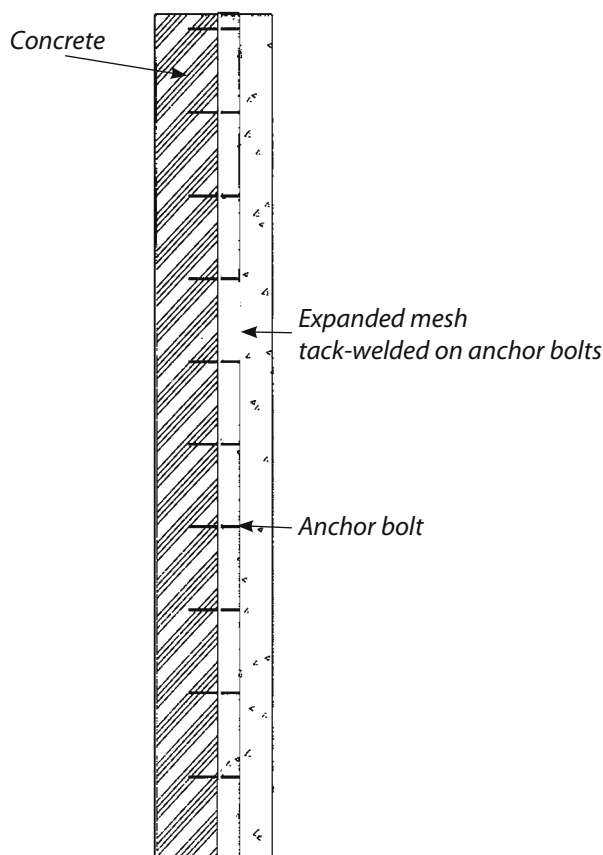
Straighten any crooked/oval steel parts. **NO** straightening may be done after the installation of Densit® WearFlex.

Concrete surfaces

If Densit® WearFlex is applied to concrete surfaces, these must be thoroughly cleaned before installation.

Clean the surface with high pressure cleaning or sand blasting to remove loose particles and impurities and to reveal the concrete aggregates.

Before installation, the concrete surface must be completely saturated with water. The surface must be wet, but the water must not pond.



To secure a good anchoring of the Densit® lining, following must be done:

1. Drill some holes in the concrete. distance app. 250 x 250 mm
2. Fasten some anchoring bolts in the holes
3. Mount the mesh over the anchoring bolts and tack-weld the mesh to the bolts.

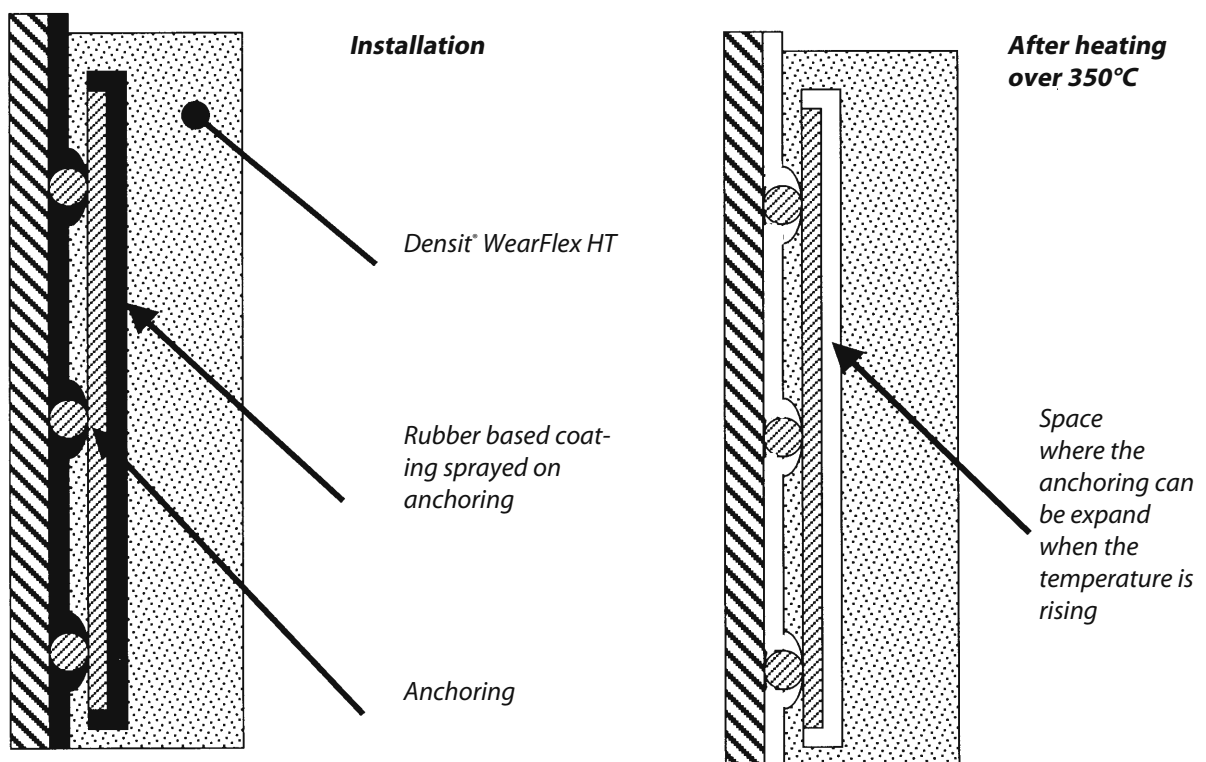
2.11 Special conditions for HT products

The fact that Densit® linings and steel expand and contract differently at different temperatures must be taken into account at high temperatures.

When the temperature increases, the steel will begin to expand. The higher the temperature, the more the steel will expand.

When installing HT products to be used at operating temperatures higher than 300°C, the anchoring and fabrication should normally be coated with a rubber-fabrication coating to ensure that the temperature expansion of the steel can be absorbed.

When the temperature increases, the rubber coating will burn/melt, thus creating a hollow space between the steel and the Densit® lining. This ensures that the steel can expand without destroying the Densit® installation.



Installation of anchoring at operating temperatures between 300 and 500°C

At operating temperatures between 300 and 500°C, the same type of anchoring as that described in section 2.5 can be used. For each installation, an assessment must be made as to whether a rubber coating is necessary or not. If a rubber coating is necessary, the following method should be used:

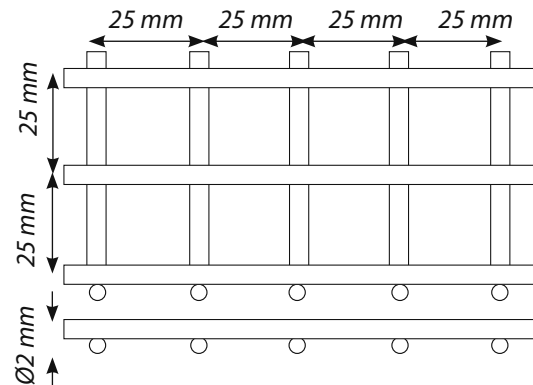
1. Choose the correct type of anchoring.
2. Weld the anchoring to the fabrication in accordance with the instructions for the type of anchoring chosen.
3. Remove all loose rust and slag, oil, grease, and the like, from the anchoring and the fabrication so the rubber coating will adhere well.
4. Spray an even thickness of the rubber coating on the anchoring and the fabrication. It can be advantageous to spray on in several thin layers. Consumption app.0,30 l/m² (1 tube).
5. The anchoring is ready for application of the Densit® compound when the rubber coating is dry. (Drying time depends on the temperature).

Installation of anchoring at operating temperatures between 500 and 800°C

At operating temperatures between 500 and 800°C the anchoring must be of steel intended for use at these temperatures. The same principles for anchoring are to be used as those described under anchoring type 2 (section 2.7).

Ordinary expanded mesh of st.37 type cannot be used at these temperatures as the steel is not oxidation stabilised and will oxidise.

A stainless steel type of mesh with thin threads must be used to reduce temperature expansion and oxidation. A mink mesh of rust solid steel for use at temperatures up to 800°C is recommended. The mesh must be made of 2 mm diameter thread with a mesh width of 25x25 mm.



Installation of mink mesh

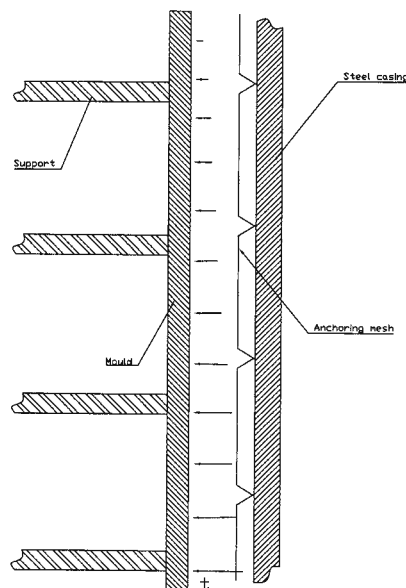
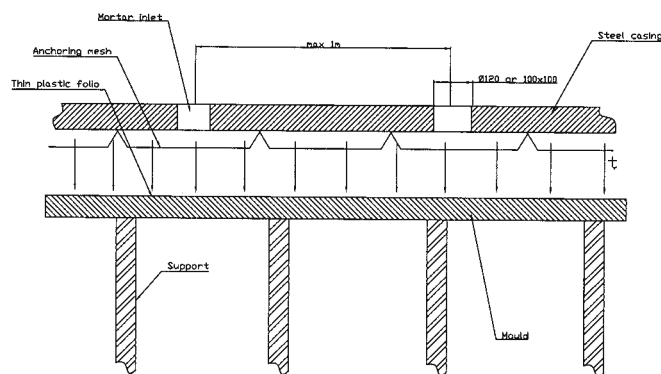
1. Weld round iron to the fabrication. The diameter must be adapted to obtain the necessary distance between the fabrication and the mink net. (See section 2.7).
2. Use filler material intended for welding rust solid steel and black steel.
3. Weld the mink mesh to the fabrication so it does not sag (is springy or dented) during the application of Densit® WearFlex.
4. Remove all slag, oil, grease, and the like, from the anchoring and the fabrication so the rubber coating will adhere well.
5. Spray an even thickness of approx. 1.5-2 mm of the rubber coating on the anchoring and the fabrication. It can be advantageous to spray the coating on in several thin layers.
6. The anchoring is ready for application of the Densit® compound when the rubber coating is dry. (Drying time depends on the temperature).

As the mesh is made from 2 mm wire it is important to use the right welding equipment so that the wire does not blow. Please observe that all weldings are made correctly so that the mesh does not move.

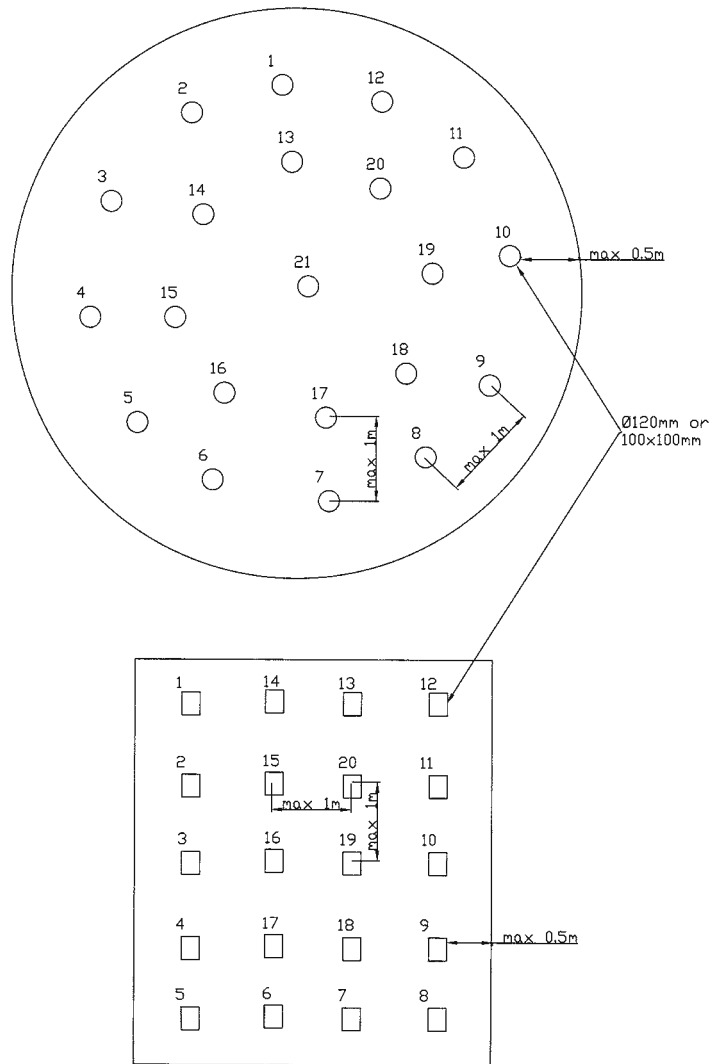
2.12 Building the mould and shuttering (Casting only)

The mould may be made of wood, plywood, vacuum-formed plastic, glass or steel. If a very smooth surface is required, this can be achieved by polishing the mould before pouring. Since Densit® reacts chemically with several types of light metal, it must not come in contact with galvanised surfaces or with aluminium.

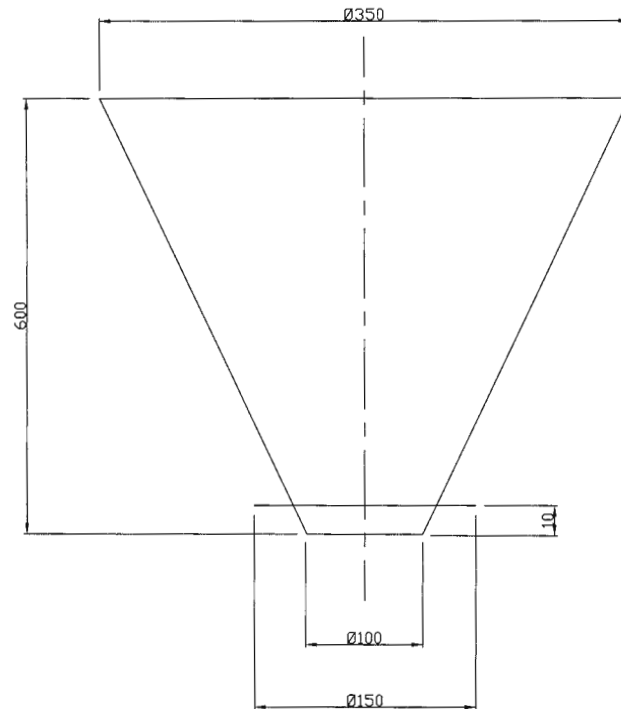
The mould and shuttering must be sufficiently stiff and strong to carry the weight of the Densit® mortar safely without deflecting remarkable. For horizontally oriented moulds the load carried by the supports is approximately 3 kg/m^2 mould surface for each mm (t) thickness of Densit® material in the mould. For vertically oriented moulds the load carried by the bottom support is approximately 2 kg/m^2 mould surface for each mm (t) thickness of Densit® material in the mould. The load carried by the top support is approximately 1 kg/m^2 mould surface for each mm (t) thickness of Densit® material in the mould.



It is important to that the inlets are placed correct and filled in the right order.



Inlets should be \varnothing 120 mm or 100x100 mm with a distance of no more than 1 meter. To make sure that no air is trapped keep on filling in mortar in one inlet until the mortar has passed by the next inlet. Then move to the next inlet. To make the inlet more effective a funnel can be used



Also the use of a small electric stick-vibrator (ex. \varnothing 15 x 200 mm) can make the process more effective. The stick-vibrator must be used from the inlet the mortar is floating against.

To make the mortar float easily it is advisable to cover the mould and shuttering with a thin plastic folio. If the mould has not been covered with plastic folio and it should be re-used or just for making disassembling easier, the mould should be coated with a mineral oil or another suitable release material. Only a thin layer of mineral oil must be used. Otherwise, too much mineral oil can get mixed with the Densit® material and will destroy the mortar.

3. Mixing

The mixing time and the correct addition of water are decisive for the correct workability of Densit® WearFlex. The following chapter describes the mixing procedure for WearFlex materials.

Table of contents

| | | |
|------------|---|------------|
| 3 | Mixing | 3.1 |
| 3.1 | Checklist | 3.2 |
| 3.2 | Mixing site requirements | 3.3 |
| 3.3 | Mixer requirements | 3.4 |
| 3.4 | Climatic conditions | 3.5 |
| 3.5 | Mixing procedures | 3.6 |
| 3.6 | Special conditions for HT products | 3.9 |
| 3.7 | Special conditions for casting on site (Casting only) | 3.11 |



3.1 Checklist

| | Section | OK |
|--|---------|----|
| 1 Is there access to clean water? | 3.2 | |
| 2 Is the power supply correct for the mixer? | 3.2 | |
| 3 Is an efficient paddle pan mixer available? | 3.3 | |
| 4 Are scales, buckets, litre measures, etc. available? | 3.2 | |
| 5 Have weather conditions been taken into account? (Temperature, covering of mixer) | 3.4 | |
| 6 Is the mixer situated as close to the installation site as possible? | 3.2 | |
| 7 Is correctly stored material available? | 3.2 | |
| 8 Are the installers familiar with the mixing procedure? | 3.5 | |
| 9 Can the compound be transported to the installation site? | 3.2 | |

3.2 Mixing site requirements

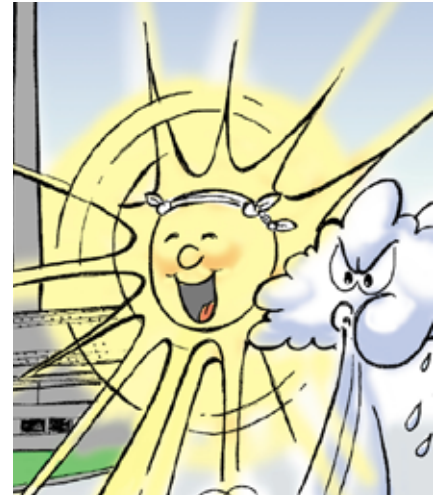
Placing the mixer

The mixer must be placed as close to the installation site as possible.

There must be access to power supply and clean water.

Avoid long distances between the mixer and the water taps as a large amount of water is normally needed for an installation.

It is recommended that one man should stand by the mixer all the time so he can ensure the uniform consistency of the compound. The installation work must be given priority when scheduling work periods and breaks; stops/breaks in the mixing will necessitate extra cleaning of the mixer.



Densit® WearFlex

Densit® WearFlex material must always be protected from rain and moisture during storage. The pallets may be raised 20 cm, so that moisture cannot penetrate from below. Material in packaging that has been opened should never be used. There must be no hard lumps in the material when the sacks are opened. Damaged material must be discarded. Ready-mixed Densit® WearFlex compound should be stored for as short a time as possible. The mixing of the compound must be adjusted to correspond to application as the compound should always be used immediately after mixing. The compound may be transported by wheelbarrow or in large buckets. The wheelbarrow or bucket may be moistened before filling with compound.

Equipment

The necessary mixing equipment must be available:

- Paddle pan mixer
- Bucket with litre marking for dosage of water
- Litre measure for dosage of extra water
- Scales to weigh steel fibres
- Stop watch to monitor mixing time
- Wheelbarrow/buckets for transporting compound



3.3 Mixer requirements

Type of mixer

An efficient paddle pan mixer with correctly adjusted mixer blades is recommended. The paddle pan mixer must be equipped with a strong electric motor. Typical power consumption is 20 W per kg Densit® WearFlex material. A paddle pan mixer with about 33 rpm is recommended.

A gravity batch mixer cannot be used. Any wheels on the mixer should be hard wheels without air, as the use of steel fibres increases the risk of punctures.

The paddle pan mixer must always be cleaned thoroughly before use, and any remaining residue of old material must be removed.

A paddle pan mixer such as a Staring L.H. 125 with reinforced gear and motor may be used. The mixer is fitted with reinforced mixer arms coated with hard metal on the blades and on the emptying hatch at the bottom of the tank.

Technical specifications - Staring L.H. 125

| | |
|---------------------------------|-------------|
| Gross volume: | 125 l |
| Yield per mix: | 100 kg |
| Pan diameter: | 735 mm |
| Pan height inside: | 315 mm |
| Total height: | 1150 mm |
| Total weight: | 140 kg |
| Emptying height: | 650 mm |
| Main axle rpm | 34 |
| Number of mixer blades: | 4 |
| Electric motor (3x400 V-50 Hz): | 2.2 kW |
| Connection: | 16 amp plug |



3.4 Climatic conditions

The correct amount of water is dependent on the temperature of the surroundings and the relative humidity.

When mixing Densit® WearFlex materials a minimum amount of water should be added to begin with as stated on the bags. Depending on the climatic conditions, extra water can be added in portions of 70 ml per 25 kg Densit® WearFlex material. Mix the material until the desired consistency is obtained.



Heat

At high temperatures there will

be considerable evaporation, thus increasing the need for extra water.

Avoid direct sunlight, rain and wind. If necessary, a tent can be erected so the Densit® material can be mixed under cover. Likewise, water tanks/water hoses should be protected from sun/heat. The water in water tanks/water hoses can easily become very hot. When transporting compound at high temperatures, evaporation can be avoided by covering the compound with a thin layer of water during transport.

Frost

Densit® WearFlex materials should not be mixed at temperatures below 5°C as the compound must never be applied if the fabrication or the air temperature is less than 5°C. Densit® WearFlex must be protected against frost during setting. At 5°C the compound must be protected for a minimum of 4 days against lower temperatures.

If the Densit® WearFlex lining is exposed to frost before it has set the formation of ice crystals will damage the compound. This will cause deep cracks during curing which will, among other things, reduce the density and durability of the Densit® WearFlex lining.

Water temperature

Use water at temperatures from 5 to 40°C, depending on the air temperature. When mixing at low temperatures it is advantageous to use hot water. When mixing at high temperatures it is advantageous to use cold water.

Ice can be used to reduce the temperature of the water, but not dry ice.

3.5 Mixing procedures

WearFlex must be mixed in an efficient paddle pan mixer. (Check that the mixer goes the right direction). The amount of water stated on the bags must be used. Always use clean water. Do not use water which has been used to clean tools, etc. Impurities in the water can reduce the strength and durability of Densit® WearFlex and cause problems in mixing the material.

- Add a minimum amount of water to the dry powder during mixing. The water must be poured evenly and slowly.
- Mix for 5 minutes after the water has been added. (Within 3 minutes, the appearance of the mixture will change from a dry powder to a wet and sticky compound).
- If necessary, add extra water in portions of 70 ml per 25 kg bag (about half a cup of water), until the right consistency is obtained.
- After each addition of extra water, mix for at least one more minute.



*The compound is too dry.
Add more water.*



*The compound is OK.
Ready to install.*

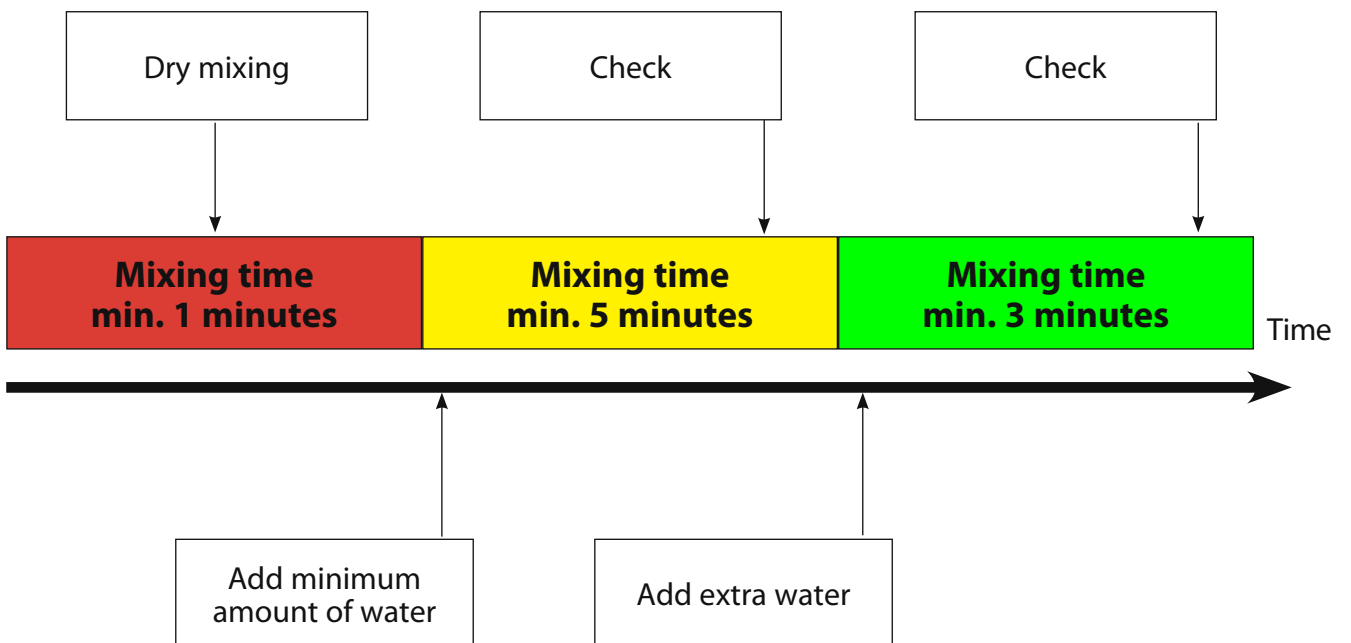


*The compound is too wet.
Discard the compound.*

When mixing is completed, check the workability of the compound again. If the compound can be shaped into a “wet ball”, then it has good workability and can be applied without difficulty.



Mixing procedure



If the compound is to be applied overhead it is recommended that an additional 3 minutes be added to the mixing time to get a stickier compound.

After the first couple of mixes with the correct consistency have been mixed, the amount of water used can provide the guideline for the following mixes.

As the product may vary, it is, however, recommended that the minimum amount of water used for the following mixes should be reduced by 1-2 portions of water (70-140 ml). Then add the rest of the water as needed. The total mixing time must still be at least 10 minutes before the steel fibres are added.

If the compound does **not** become a wet and sticky mass during the first 3 minutes, extra water must be added in portions of 70 ml. The compound must be mixed for at least 1 minute after each addition of water. When it becomes a wet and sticky compound the compound must be mixed for at least 3 minutes before the addition of any more water.

Check the efficiency of the mixer if the compound still does not become a wet and sticky compound.

If the mixing time is longer than instructed, the compound may lose its workability. This can be checked by keeping an eye on the temperature of the compound. If the temperature starts to increase, the mixing time is too long.



If a suitable workability cannot be obtained the compound **should not be used**.

Potlife is the time that elapses from the compound is mixed until it is no longer workable. Potlife is about 20 to 60 minutes, depending on climatic conditions.

If the compound is not to be used as soon as mixing is completed, it should be mixed again just before use. If the compound starts to set in the mixer, it must be discarded.

3.6 Special conditions for HT products

Mixer

Mixers which have been used to mix other products should not be used. The mixer must not be polluted with residues of other products containing cement, clay or limestone, other Densit® products or with salts of any kind. Extra care should be taken with cleaning. For example, sand blast the mixer before use. If the mixing procedure is stopped, the mixer must be cleaned again before use.

If a mixer which has not be thoroughly cleaned is used, the potlife of the compound can be greatly reduced or in worst case harden.

Temperature

The work temperature when mixing is between 5-40°C. The pot-life of the compound is reduced at higher temperatures. **The temperature of the water should never exceed 20°C.**

Mixing procedure

- Add the minimum amount of water to the dry powder. Follow the instructions on the bag.
- Mix Densit® WearCast HT with the minimum amount of water for min. 8 minutes. Within 3 minutes the mixture should change from a dry powder to a wet and sticky compound.
- Check the consistency
 - If the material is too dry, add 70 g extra water and mix for an extra 2 minutes.
- The total mixing time must be at least 8 minutes before the addition of the steel fibres.
- If the consistency is right, add 1.1 kg steel fibres per 25 kg Densit® WearCast HT.

Rec. steel fibre type:

Service temperature max.: 1100°C ISO 4955

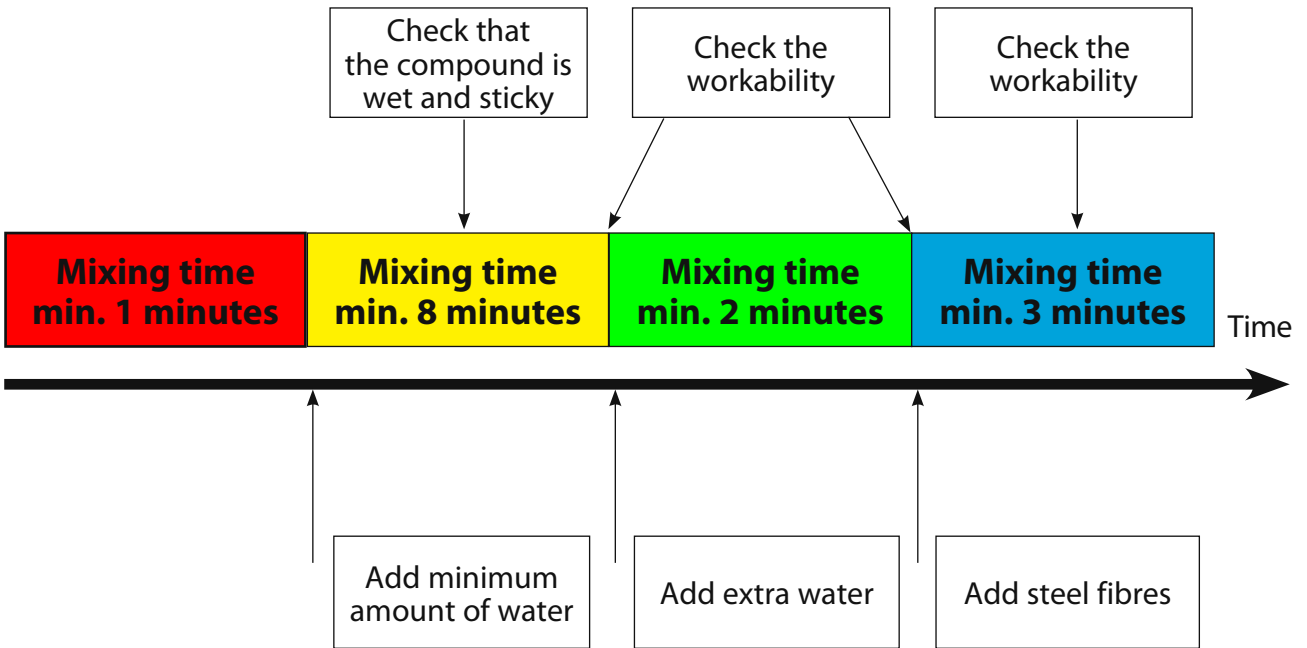
800°C ISO 3581

400°C ISO 4995

- Mix for an additional 2 minutes
- The total mixing time must be at least 15 minutes

When mixing is completed, the workability of the compound should be checked again. If the compound can be shaped into a "wet ball", it has good workability and can be applied without difficulty.

Mixing procedure



3.7 Special conditions for casting on site (Casting only).

WearCast must be mixed in an efficient paddle pan mixer. (Check that the mixer goes the right direction). The amount of water stated on the bags must be used.

Always use clean water. Do not use water which has been used to clean tools, etc. Impurities in the water can reduce the strength and durability of Densit® WearCast and cause problems in mixing the material.

- Add a minimum amount of water to the dry powder during mixing. The water must be poured evenly and slowly.
- Mix for 8 minutes after the water has been added. (Within 3 minutes, the appearance of the mixture will change from dry powder to a castable compound).
- If necessary, add extra water in portions of 70 ml per 25 kg bag (about half a cup of water), until the right consistency is obtained.
- After each addition of extra water, mix for at least 2 more minutes.
- The total mixing time before adding the steel fibres must be at least 8 minutes.
- If the consistency is right, add 1.1 kg steel fibre per 25 kg sack. The steel fibres should be sprinkled slowly and carefully without forming lumps in the compound.
- Mix for an additional 3 minutes.

4. Installation

Correct and careful application of Densit® is vital for correct installation. This chapter describes how application should be carried out.

Table of contents

| | |
|---|-------------|
| 4. Installation | 4.1 |
| 4.1 Checklist | 4.2 |
| 4.2 Equipment | 4.3 |
| 4.3 Confirming the fabrication | 4.4 |
| 4.4 Confirm the anchoring | 4.5 |
| 4.5 Climatic conditions | 4.6 |
| 4.6 Joints | 4.7 |
| 4.7 Confirm installation | 4.8 |
| 4.8 Method of procedure | 4.9 |
| 4.9 Special conditions for HT products | 4.13 |
| 4.10 Special conditions for WearCast used on site | 4.14 |



4.1 Checklist

| | Section | OK |
|---|---------|----|
| 1 Has the area that needs to be lined been indicated? | 4.2 | |
| 2 Is the correct amount of material on site? | 4.2 | |
| 3 Are the correct tools available? | 4.2 | |
| 4 Has the fabrication been adequately cleaned? | 4.3 | |
| 5 Is the anchoring placed/welded correctly? | 4.4 | |
| 6 Are the necessary retaining bars installed? | 4.4 | |
| 7 If necessary, have steel parts been fitted prior to installation? | 4.3 | |
| 8 Has any necessary division into sections been carried out? | 4.6 | |
| 9 Have climatic conditions been taken into account? | 4.5 | |
| 10 Is the necessary scaffolding available? | 4.8 | |
| 11 Can Densit® WearFlex be installed correctly? | 4.4 | |

4.2 Equipment

The following tools are needed for correct installation:

- A compound board and trowel to apply Densit® WearFlex.
- A ruler to check the thickness of the layer.
- Buckets/wheelbarrow to carry the compound.
- Curing spray to apply Densit® Curing Compound.
- If needed, lifting gear or the like to transport the compound.
- If needed, insulating blankets to cover Densit® WearFlex after application.
- Scaffolding, if necessary.

| General guidelines for material consumption for Densit® WearFlex installations | | | | |
|---|--|--------------------------------|----------------------|-----------------------|
| Consumption of Densit® WearFlex: | | | | |
| Densit® WearFlex material | Kg/mm/m ² | Thickness of the layer applied | | |
| | | 20 mm | 30 mm | 40 mm |
| Densit® WearFlex 500 | 2.5 | 50 kg/m ² | 75 kg/m ² | 100 kg/m ² |
| Densit® WearFlex 2000 | 2.9 | 58 kg/m ² | 87 kg/m ² | 116 kg/m ² |
| Densit® WearFlex 2000 HT | 3.0 | 60 kg/m ² | 90 kg/m ² | 120 kg/m ² |
| Remember to incorporate any spillage of Densit® WearFlex | | | | |
| Consumption of other materials: | | | | |
| Steel fibres: | 1.1 kg per 25 kg Densit® WearFlex | | | |
| Densit® Curing Compound | 0.2-0.3 l/m ² | | | |
| Expanded mesh | Approx. 1.1 m ² mesh Densit® installation | | | |

4.3 Confirming the fabrication

Metal surfaces

Before installing Densit® WearFlex, all loose rust and slag, soot, oil, grease and the like, must be completely cleaned off the fabrication and the anchoring. A pneumatic or high pressure cleaner may be used.

If the fabrication is galvanised or of a lightweight metal alloy it must be coated with a watertight coating to hinder a chemical reaction with Densit® WearFlex.

Concrete surfaces

If Densit® WearFlex is to be applied on a concrete surface, this must be thoroughly cleaned before application. The surface and the anchoring must be high pressure cleaned or sandblasted to remove any loose particles or impurities and to reveal the concrete aggregates.

Before application, the concrete surface must be thoroughly saturated with water. The fabrication must be wet, but the water must not pond.

Checking the shape

Before application of Densit® WearFlex check to make certain that the parts have the correct shape.

Straighten any crooked/oval steel parts. No straightening may be done after the installation of Densit® WearFlex.

See section 2.2.

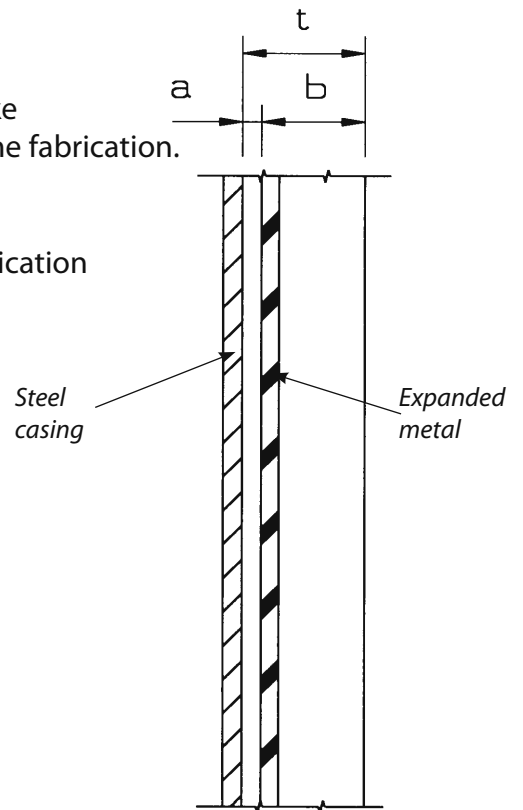
4.4 Confirming the anchoring

Before application of Densit® WearFlex check to make certain that the anchoring is correctly attached to the fabrication.

Check the placement of the anchoring

The anchoring must be attached parallel to the fabrication at the following distances from the fabrication.

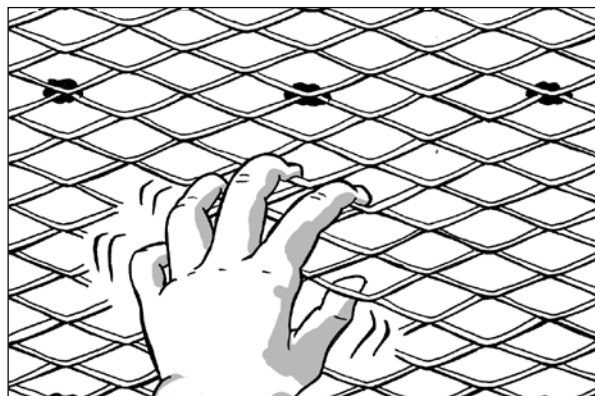
| Distance from the fabrication | |
|-------------------------------|----------|
| Thickness | Distance |
| 25-30 mm | 5-6 mm |
| 30-35 mm | 6-8 mm |
| 35-40 mm | 8-10 mm |



Checking the stiffness of the anchoring

Then anchoring must be so firmly attached to the fabrication that the mesh does not move when the compound is applied. Make certain the anchoring is properly welded onto the fabrication by pulling on it.

The anchoring must not be loose, and it must not be possible to pull it away from the fabrication.



Confirm the position of the retaining bars

If the abrasive materials can hit the edge of the lining at a right angle, this edge must be protected with a permanently fitted retaining bar.

4.5 Climatic conditions

The climatic conditions at the installation site are of great importance for the execution and the quality of the Densit® WearFlex lining.

The work temperature for Densit® WearFlex compound is between 5-40°C.

The fabrication

The temperature of the fabrication must not exceed the work temperature of Densit® WearFlex. Protect the fabrication against rain after preparation.

At high temperatures the fabrication must also be protected against the effects of the sun.

For example, cold water can be sprayed on the fabrication immediately before the application of Densit® WearFlex.

At low temperatures ensure that the temperature of the fabrication is at least 5°C by covering with insulating blankets or by setting up hot-air heaters.

Frost

Densit® WearFlex must not be installed at temperatures below 5°C. A hot-air heater can be used at the work site to increase the temperature. If the Densit® WearFlex lining is exposed to frost before it has set, it will be damaged due to the formation of ice crystals. This will reduce the strength, density and durability of the linings.

If there is a risk of frost, insulating blankets or the like must be used to cover the surface after installation.

Make certain the installation maintains a temperature of at least 5°C for at least 4 days.

Heat

When Densit® WearFlex is installed at high temperatures there will be considerable evaporation of water from the compound, thus reducing the workability time of the compound. Always protect the Densit® WearFlex lining against direct sunlight. At high temperatures, installation should be carried out at night when the temperature is often more suitable.

4.6 Joints

When Densit® WearFlex is to be applied to a large area it is necessary to divide the area into smaller sections, so the compound can be applied in a continuous operation in each section.

It is important to finish each section with a sharp edge.

An area can be divided into sections by fitting wooden battens on the expanded mesh. The battens should have the same thickness as the lining, so they will be level with this when installation is completed.



4.7 Confirm installation

It is important to check the execution of the installation regularly to ensure satisfactory installation.

It is important to apply the Densit® WearFlex compound very carefully as faults or unevenness cannot be corrected in the finished Densit® WearFlex lining. The surface of the finished Densit® WearFlex lining must be level without unevenness and have the correct thickness.

Ruler

Check regularly to see that the correct thickness of the Densit® WearFlex compound has been applied.

Check regularly with a ruler or the like to see that the application has the correct thickness.

Make sure that the measuring tool is pressed all the way down to the fabrication.

Check for air pockets

Check regularly during application of the fresh compound to ensure that the Densit® WearFlex compound is pressed in behind the anchoring so no air pockets occur in the lining, as this can cause dislodging of the Densit® WearFlex lining.

Use a trowel to scrape some Densit® WearFlex compound off to reveal the anchoring (about 10x10cm). Check to see whether there are any air pockets. If there are air bubbles, more Densit® WearFlex compound must be pressed in behind the anchoring during application.

After completing the check, apply Densit® WearFlex again on the area and smooth off with the mortar board.

If the check reveals air pockets, the compound that has already been applied must be removed and discarded. New Densit® WearFlex compound must be applied to areas where air pockets are found.



4.8 Method of procedure

When applying Densit® WearFlex compound, consideration must be given to the position in which it is to be applied. There must be plenty of room and easy access to the areas where Densit® WearFlex is to be applied. Erect scaffolding to provide a good working position for the person or persons applying Densit® WearFlex to ensure that the current work is of a satisfactory quality.

There are three application positions:

The horizontal position:

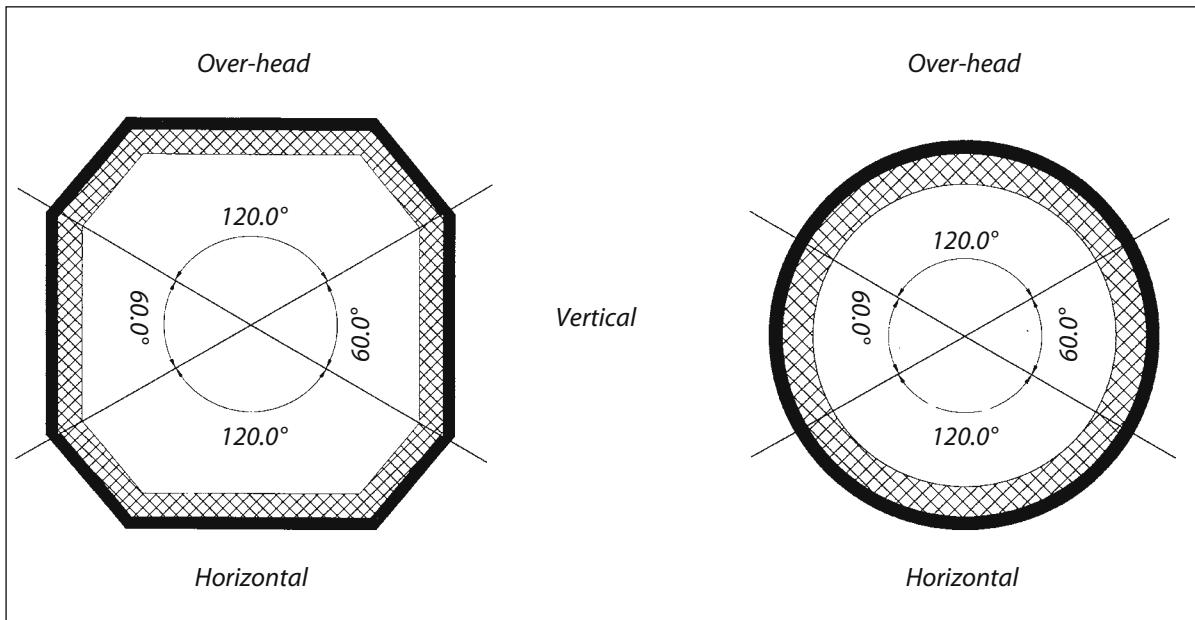
This position covers applying the compound on horizontal surfaces, at the bottom of round pipes and on sloping surfaces.

The vertical position:

This position covers applying the compound on vertical surfaces and on the sides of pipes.

The overhead position:

This position covers applying compound on roofs, at the top of pipes and on slopes near roofs.



Application on horizontal surfaces:

The best way to apply Densit® WearFlex compound on horizontal surfaces is by laying a large amount of Densit® WearFlex compound, about 10 litres, on the fabrication.

Then distribute this compound to all sides with a mortar board.

Work with the compound until the desired thickness is obtained.

Check the thickness of the layer regularly.

Check at regular intervals to see that the Densit® WearFlex compound has been pressed all the way behind the anchoring.

The finished surface should be level without unevenness and have the correct thickness.



Application on vertical surfaces:

Take the freshly mixed Densit® WearFlex compound from the bucket and place it on the mortar board. Take the mortar board to the surface with the anchoring and press the compound in between the anchoring and the fabrication. Draw the mortar board upwards while, at the same time, moving it quickly from side to side with small movements. Using this method, Densit® WearFlex compound is easy to work with, and it is possible to work the compound well in between the fabrication and the anchoring. The correct thickness must be achieved while the compound is "wet". This means that Densit® WearFlex compound must not be applied on top of compound which has lost its workability/form skin.

Check the thickness of the layer regularly.

Check at regular intervals to see that the Densit® WearFlex compound has been pressed all the way behind the anchoring. The finished surface should be level without unevenness and have the correct thickness.



Overhead application:

It can be advantageous to increase the mixing time for the compound to be used for overhead application by 3 minutes to obtain a stickier compound.

Place the freshly mixed Densit® WearFlex compound on the mortar board.

Press the compound up into the anchoring and draw the mortar board back while, at the same time, making small side to side (zig-zag) movements. Using this method, Densit® WearFlex compound is easy to work with, and it is possible to work the compound well in between the fabrication and the anchoring.



The correct thickness must be achieved while the compound is “wet”. This means that Densit® WearFlex compound must not be applied on top of compound which has lost its workability. In order to do this work correctly, the person applying Densit® WearFlex must stand so close to the surface above him that it is necessary to incline his head sideways. It is necessary to stand this close to the surface to be able to put sufficient pressure on the mortar board during application.

Check the thickness of the layer regularly.

Check at regular intervals to see that the Densit® WearFlex compound has been pressed all the way behind the anchoring.

The finished surface should be level without unevenness and have the correct thickness.



4.9 Special conditions for HT products

At operating temperatures between 300 and 500°C the methods of application can be used as for operating temperatures under 300°C.

A special type of anchoring mesh must be used for operating temperatures between 500 and 800°C. This mesh is not stiff enough to be used for overhead application. Lathing/formwork must be used for overhead application. Horizontal and vertical application may be made in the same way as for operating temperatures of less than 300°C.

The Densit® lining and the fabrication will be strongly affected by heat at high operating temperatures. This carries with it a risk of great tension in the fabrication that may result in displacement/expansion. This displacement/expansion can destroy the Densit® installation. To avoid this, at high operating temperatures it must always be considered whether insulation should be laid between the fabrication and the Densit® lining. Use the Densulate concept. Contact Densit a/s for further information.

Contact Densit ApS for advice for operating temperatures higher than 800°C.

4.10 Special conditions for WearCast used on site

After being worked up into a mixture ready for pouring, Densit® WearCast can easily fill even complicated forms. Pouring must always take place immediately after the material has been mixed and should be finished no later than half a hour (at 20°C) after mixing. Generally, higher temperature reduces the time from mixing to installing must be finished. The pouring must always be accompanied by vibrating. One or two vibrating unit(s) should be attached on plane areas away from supports and corners that stiffens the mould and prevent free vibration of the mould surface. If more than two vibrating units are used at the same time there is a great risk that the vibrations from some units to some extend cancels out each other.

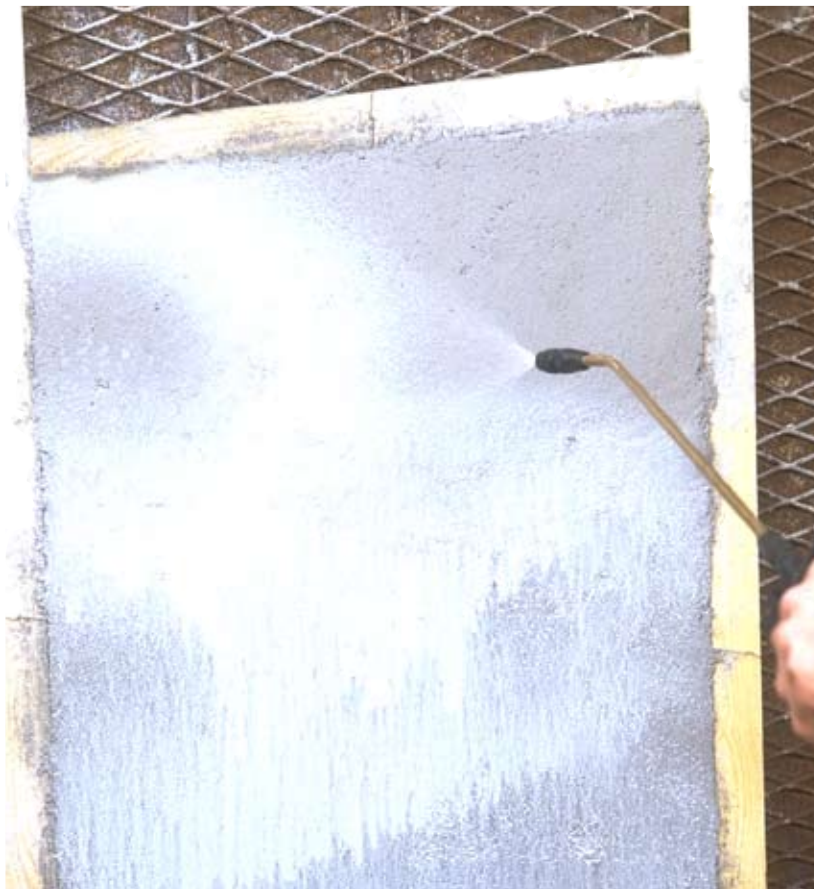
After pouring, the free surface should be protected against drying out as described in chapter 5.2.

5. Finishing

If the Densit® WearFlex installation is to be used in environments with temperatures above 100°C, all excess water must be dried out of the wear lining to avoid cracks due to steam.

The water in the compound will evaporate from the surface during curing of the Densit® WearFlex lining. This will reduce the durability of the Densit® WearFlex lining. In order to hinder this, the surface of the Densit® WearFlex lining must be protected.

| | |
|--|------------|
| 5. Finishing | 5.1 |
| 5.1 Checklist | 5.2 |
| 5.2 Applying curing compound..... | 5.3 |
| 5.3 Strength development..... | 5.4 |
| 5.4 Repair of Densit® WearFlex | 5.5 |
| 5.5 Drying out of Densit® WearFlex | 5.6 |
| 5.6 Special conditions for WearCast used on site | 5.7 |



5.1 Checklist

| | Section | OK |
|---|---------|----|
| 1 Has the Densit® Curing Compound been correctly applied? | 5.2 | |
| 2 Has the installation been protected against frost? | 5.3 | |
| 3 Has the installation been correctly screened off to avoid damage? | 5.3 | |
| 4 Has the installation been correctly supported prior to lifting? | 2.2 | |
| 5 Has the installation been carried out in accordance with Densit's instructions? | 4 | |
| 6 Has the Densit® WearFlex lining attained sufficient strength prior to use? | 5.3 | |

5.2 Applying curing compound

Immediately after the surface is finished, it must be protected against drying out. This is normally done by spraying with Densit® Curing Compound. A good quality atomiser with attached nozzle is well-suited to the job. Use about 0.2-0.3 l/m².

Densit® Curing Compound is a surface sealer which is sprayed onto the Densit® WearFlex lining to retain the water in the Densit® WearFlex after installation. Densit® Curing Compound counteracts drying out.

Densit® Curing Compound must always be sprayed on immediately after finishing the Densit® WearFlex lining.

If Densit® WearFlex is being applied to large areas, it is necessary to seal it in stages. This is especially important if the installation is carried out in a hot environment.

When applying Densit® Curing Compound you must take care not to apply it on unfinished surfaces.

It is not necessary to remove Densit® Curing Compound prior to taking the wear lining into use.



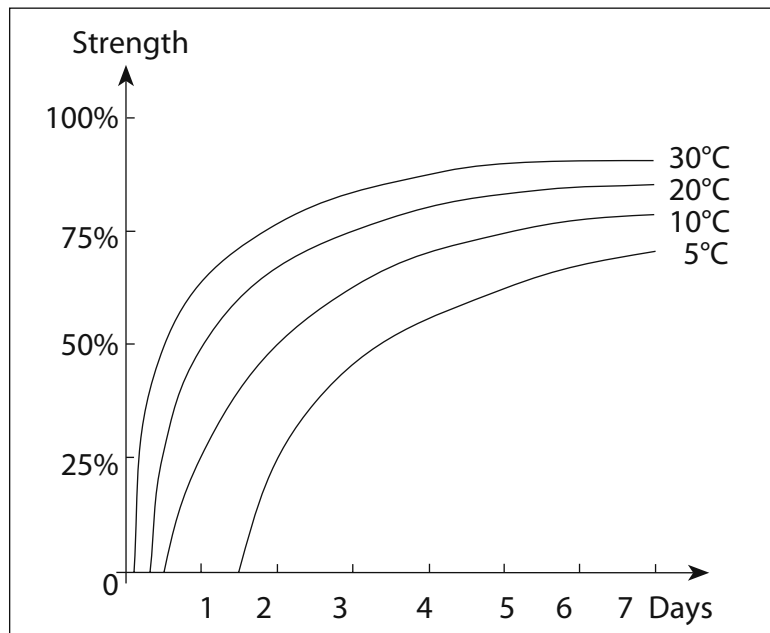
If there is no Densit® Curing Compound available, you can cover the finished Densit® WearFlex surface with tight-fitting plastic.

5.3 Strength development

The installation must be protected against frost during setting. (4 days at 5°C). If the compound is exposed to frost before it is set, it will be damaged by ice crystals. This will, among other things, reduce the strength, density and durability of the lining. If the compound is exposed to frost after setting, the curing process will stop but will start again when the temperature rises. The setting time is calculated from the time the Densit® WearFlex compound is mixed until the strengthening process begins.

At temperatures of 20°C, the strength development process begins after about 10 hours, and it then takes approximately 2 days curing for the material to attain full strength and be ready for use. In a surrounding temperature of 5°C, the curing time before strength development is (considerably) longer, about 7 days.

During the first days, the strength development is very dependent on the surrounding temperature. A Densit® WearFlex lining should not be used until at least 60% of its final strength has been attained. The following table shows the influence of temperatures on the strengthening process. These values are only guidelines.



| Approx. 60% of the strength | | | | | | | | |
|-----------------------------|--------|--------|--------|--------|----------|----------|----------|----------|
| Temperature | 5°C | 10°C | 15°C | 20°C | 25°C | 30°C | 35°C | 40°C |
| Curing time: | 7 days | 4 days | 3 days | 2 days | 38 hours | 30 hours | 25 hours | 20 hours |

The strengthening process can be accelerated by heating. Note that the heat must not be directed directly onto the Densit® WearFlex lining as heat has a drying effect.

During setting and the strengthening process small cracks may appear in the Densit® WearFlex surface. These cracks have no significance for the operation of the lining.

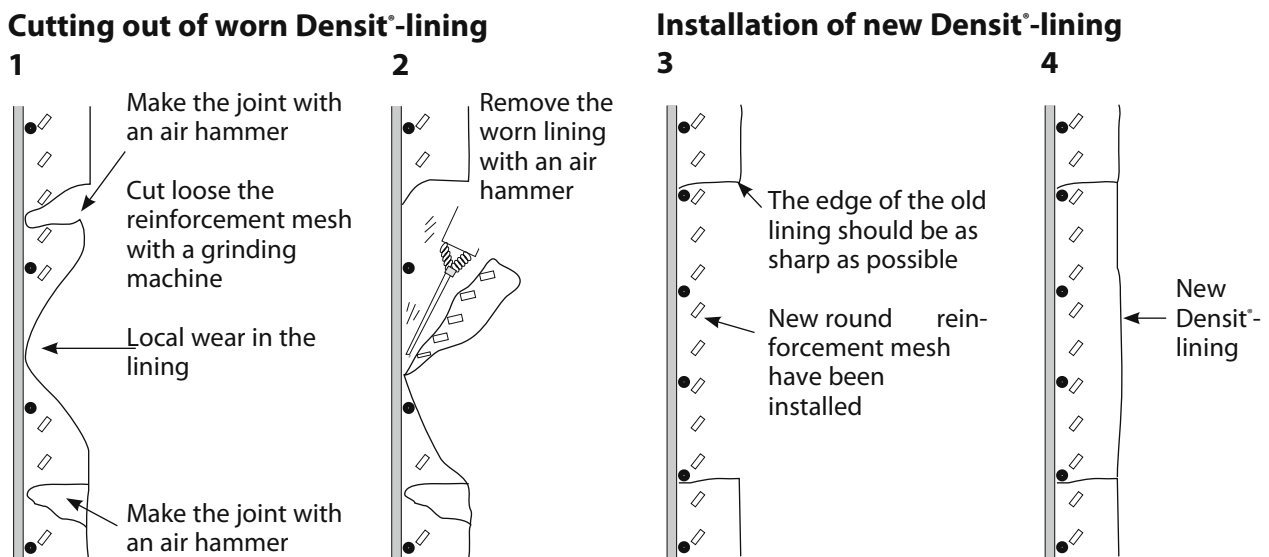
5.4 Repairing Densit® WearFlex

Densit® WearFlex linings can be repaired as follows.

To obtain the necessary adherence it is necessary to clear areas of the existing Densit® WearFlex lining beneath the anchoring. Likewise, you should ensure that the new Densit® WearFlex lining has an overall thickness of at least 15 mm. New expanded mesh must be fitted.

Clean the surface thoroughly, may be sandblasted.

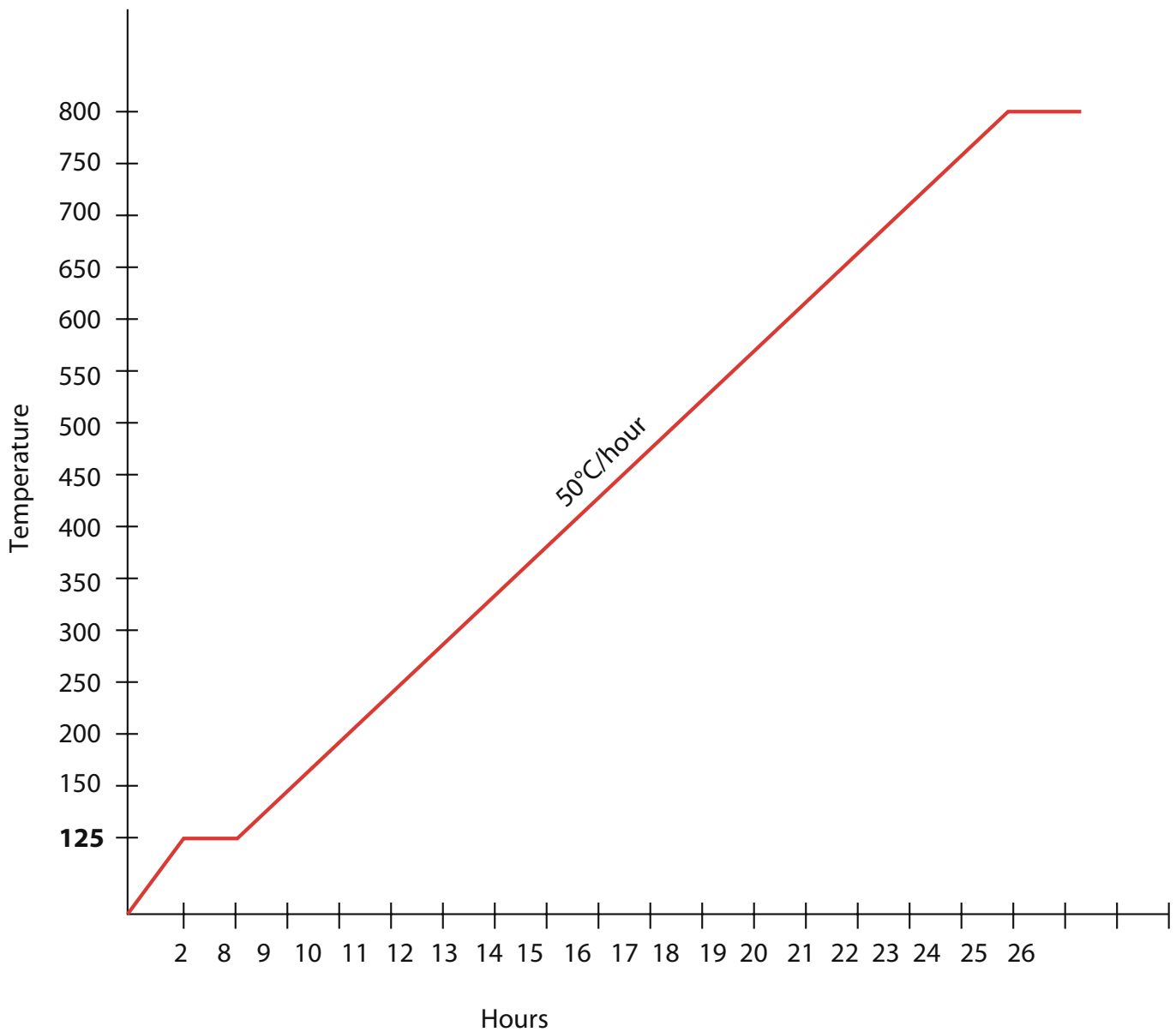
Then follow the ordinary installation procedure.



A thicker layer of Densit® WearFlex should be applied to areas being repaired and the edges surrounding the repair should be conical.

5.5 Drying out of Densit® WearFlex®

If the Densit® WearFlex installation is to be used in environments with temperatures above 100°C, all excess water must be dried out of the wear lining to avoid cracks due to steam. It is recommended that drying out is done according to the diagram shown below. Note that the time before drying can be started corresponds to the strengthening process. Drying out should not commence before 65%-75% of the final strength has been attained. This means that the surrounding temperature must be taken into account when planning the drying process. It is recommended that drying should be done at 50°C per hour.



5.6 Special conditions for WearCast used on site

Depending on the size and shape of the mould and on the local climate, disassembling the mould can take place 8-62 hours after pouring. Especially the air temperature controls the setting time and also the following strength development rate. To be sure that the lining is self-supporting certain strength must be obtained before the mould or mould supports are removed. The following table shows the temperature dependency of the time (in hours) from pouring to the mould or mould supports can be removed.

| Ambient temperature | 5°C | 10°C | 15°C | 20°C | 25°C | 30°C | 35°C | 40°C |
|---------------------|------|------|------|------|------|------|------|------|
| Demoulding time | 62 h | 36 h | 24 h | 18 h | 14 h | 11 h | 9 h | 8 h |



Densit ApS · Tel.: +45 9816 7011 · Fax: +45 9933 7788 · E-mail: mail@densit.com · Internet: www.densit.com

German office:

Densit ApS · Fritz-Peters-Str. 40 · D-47447 Moers · Tel.: +49 2841 88237-0 · Fax: +49 2841 88237-10 · E-mail: ger@densit.com